

CHAPTER 3 REFUGE MANAGEMENT ALTERNATIVES

Introduction

In this chapter, management alternatives for the Gorge Refuges are described. Each of the proposed alternatives is a different way of supporting Refuge vision and goals, while responding to key issues, management concerns, and opportunities identified during the planning process (Chapter 2). Some of the actions proposed in the CCP/EA are common to all alternatives and would occur regardless of which alternative is implemented. These actions are described first. Next, three management alternatives are presented. Each alternative is introduced with a narrative explanation, followed by management objectives and strategies to achieve Refuge goals. The same set of five goals apply across all three alternatives. The objectives, however, may vary between alternatives, as do the implementation strategies. At the end of the chapter, alternatives considered but eliminated from detailed study are briefly described. Table 3-1 contains a summary comparison of the alternatives.

Each objective is given a unique alpha-numeric code to indicate the specific alternative and goal to which the objective applies. For example, objective A1.1 is the first objective under goal number one in Alternative A. Objective C1.1 is the first objective under goal number one, Alternative C. Some objectives vary between two or all of the Refuges within the same alternative. In these cases, a separate objective is presented for each Refuge or group of Refuges.

Features Common to All Alternatives

Protection and Management of Cultural Resources

It is Service policy and federal law to identify, protect, and manage cultural resources located on Service lands and affected by Service undertakings. The National Historic Preservation Act requires all projects that use federal funds, permits, or licenses to be reviewed by a cultural resource specialist to determine the potential affects to cultural resources and, if needed, to conduct an inventory and identify appropriate actions to mitigate effects prior to project implementation. Service policy and federal laws also require consultation with Native American tribes, the State Historic Preservation Office, and other agencies and partners prior to project development. These consultations and site specific determinations will be completed for all projects approved in the CCP.

Steigerwald Lake Feasibility Study

Acting under the authority of Section 1135 of the Water Resources Development Act of 1986, as amended, the U.S. Army Corps of Engineers (COE) will direct the feasibility study phase of a project to reestablish hydrologic connections between the historic Steigerwald Lake, Columbia River, and Gibbons Creek (Appendix H). Restoration of riparian habitat and fish passage will also be studied. Project alternatives will be developed, and opportunities for public

involvement will be provided. The study will conclude with a COE feasibility report and associated National Environmental Policy document (EA or Environmental Impact Statement).

Gibbons Creek Water Diversion Structure, Steigerwald Lake Refuge

A water control structure on Gibbons Creek at State Route 14 diverts the creek from its old channel, which flowed into Steigerwald Lake, into an elevated channel that conveys water to the Columbia River. The design of the diversion structure does not account for bedload or debris movement at even modest flows and thus requires frequent cleaning. Pending results of the COE feasibility study, gravel and debris will continue to be periodically removed from the diversion structure pursuant to a Washington State Hydraulics Permit.

Gibbons Creek Meanders, Steigerwald Lake Refuge

The Service will work with partners, including adjacent landowners, to study opportunities to develop off-channel ponds and side-channel habitat in the Gibbons Creek reach immediately upstream from the diversion structure at Steigerwald Lake Refuge to trap sediments and provide spawning habitat. This is one of several solutions recommend by the Service to prevent salmon smolts from being entrained by spills over the concrete sill of the diversion structure and separated from the Gibbons Creek population.⁵ The meanders would be constructed on land the Service acquired in 2001 for the purpose of restoring old overflow channels, using Gibbons Creek

as a source of water.³² It is possible that acquisition of additional lands or interest therein may be required by the Service or its partners to fully meet these project objectives.

Release and Monitoring of Western Pond Turtles, Pierce Refuge

The Washington Department of Fish and Wildlife (WDFW) will continue to release and monitor juvenile western pond turtles on Pierce Refuge per an existing Memorandum of Understanding with the Service. The project objective is to establish a self-sustaining population of approximately 200 western pond turtles at Pierce Refuge following the guidelines established within the Washington State Recovery Plan for the Western Pond Turtle.²⁵

During the years 2000 through 2003, 189 juvenile pond turtles have been released at Pierce Refuge as part of the reintroduction program. These turtles are not yet considered an established population, as defined in the State's recovery plan. Breeding is not expected to occur until 2008, and evidence verifying the establishment of a self-sustaining population may not occur until 2015.

The Service will continue to coordinate and provide input and assistance annually to WDFW for the release and monitoring of turtles. The Service will allow releases to occur on approximately 15 acres of seasonal and permanent wetlands at Pierce Refuge. Pond turtle survival, dispersal, and habitat use will be estimated from data collected by radio telemetry. Mark-recapture studies will continue annually for both pond and painted

turtles to estimate population sizes and monitor for potential competition between the species. These studies will continue until a self-sustaining breeding population of pond turtles has become established.

The design and implementation of Refuge management, maintenance, and public use programs will take into consideration monitoring data, as well as western pond turtle life history and habitat requirements. During the pond turtle hibernation period (September through April), the Service will provide 40 acres of undisturbed upland overwintering habitat. The establishment of the population shall be coordinated and conducted in a manner complementary to and compatible with other existing Refuge natural resource, recreation, and cultural/historical management programs.

Western Pond Turtle Release Feasibility Study, Steigerwald Lake Refuge

The WDFW will investigate the feasibility of introducing head-started western pond turtle to Steigerwald Lake Refuge. Head-started western pond turtle are the product of eggs collected from wild populations to be subsequently hatched and reared in captivity. These 'head-started' turtles are subject to release, as juveniles, in an attempt to expand the species range within the State. The objective of this investigation will be to evaluate existing data and to establish coordination and concurrence for potential releases from the Western Pond Turtle Working Group, and conduct baseline

surveys to determine if Steigerwald Lake Refuge could support a population of head-started western pond turtles. Parameters for the establishment of this population are outlined within the Washington State Recovery Plan for the Western Pond Turtle.²⁵ Completion of this investigation will not automatically authorize the initiation of a pond turtle release program. The Service will make the final decision to allow release of the turtles after the feasibility investigation has been completed, and a final determination has been made in the COE feasibility study examining options to improve hydrological function within Steigerwald Lake (Appendix H).

The pond turtle feasibility study will conclude with a report, which will address a number of issues including but not limited to: (1) a narrative explaining that a release program will not detract from the Refuge purposes and Service priorities; (2) evaluation of historic records of western pond turtle in Clark County; (3) justification that Steigerwald Lake Refuge occurs within the Columbia River Gorge recovery segment of the Washington State Recovery Plan for the Western Pond Turtle; (4) evaluation of the western pond turtle genetics and its applicability to releases at Steigerwald Lake; (5) visual and/or trapping surveys to determine the presence or absence of pond turtles at Steigerwald Lake; (6) soil survey to determine suitability for pond turtle nesting; and (7) criteria and clearance for disease testing in head-started turtles.

Mosquito Management

The Service will continue to coordinate with local mosquito control districts to plan and implement mosquito management activities at all three Refuges. If a mosquito control district wants to monitor and treat mosquitos on Pierce Refuge or Steigerwald Lake Refuge, they are required to submit a formal written request and justification with necessary parameters identified in the Region 1 Mosquito Management Policy. If the Service determines the need for one of these activities exists, a Compatibility Determination will be prepared to evaluate the proposed action.

The Service responded to requests for monitoring and treatment at Franz Lake Refuge, by providing a description of key elements of a program and approving the program's implementation in a Compatibility Determination signed in October 2002. The following describes five actions to be taken at Franz Lake Refuge.

(1) Mosquito control district personnel will be required to monitor mosquito populations, identify species, identify primary breeding habitats, and sample/test for mosquito-borne diseases. Monitoring without follow-up treatment will be permitted only in areas suitable for mosquito breeding along the southern shoreline and east end of Franz Lake west of the dike.

(2) Treatment of mosquitoes following monitoring will be permitted only in the wetland area east of the north-south dike at the east end of Franz Lake. This site typically contains mosquitoes and is not generally suitable habitat for listed

salmonids. The only control agent authorized for use is B.t.i. Treatment may occur when dip sampling reaches or exceeds five mosquito larvae per dip, and will be site-specific. Mosquito control measures may be allowed to manage disease risk when there is a real and imminent threat to the health of human, fish, or wildlife populations, as determined by the appropriate public health agency(s) and the Service. A phased-approach for controlling disease-carrying mosquitoes will be followed.

(3) The Service has concerns for the potential negative consequences of B.t.i. treatments on nontarget invertebrates and their effects on the wetland food web, particularly if treatments are to be routine and widespread on Refuge lands. Consequently, the Service will conduct a study to examine invertebrate species composition and abundance within study plots treated with B.t.i. and within untreated control plots to determine nontarget effects. Concurrently, the Service's Columbia River Fisheries Program Office (CRFPO) will conduct a fish study with three objectives: (1) document the species of fish occurring at Franz Lake Refuge using systematic monthly surveys; (2) evaluate fish distribution relative to habitat features; and (3) describe the diets of fish inhabiting Franz Lake Refuge, particularly juvenile salmonids.

(4) The Compatibility Determination will be revised in 2012, or sooner, to reflect new information and to comply with final Service regional guidelines and national policy for mosquito management on units of the National Wildlife Refuge System.

(5) The Compatibility Determination established the groundwork for allowing nuisance-related treatments in a selected area of the Refuge. The Service also expects to develop a contingency plan following a Service designated format as soon as possible to identify the authorizing agencies, responsible parties, treatment protocol, and contact lists to be used in the event of a disease outbreak.

Chum Salmon Monitoring, Pierce Refuge

The Service's CRFPO began estimating adult and juvenile chum salmon abundance in Hardy Creek in 1997. Since 1999, the Bonneville Power Administration (BPA) has provided funding to the Service to continue investigating chum salmon in Hardy Creek, Hamilton Springs, and the Ives Island channel. The overall goal of these investigations is to evaluate factors limiting chum salmon populations in the Columbia River Gorge. Specifically, understanding factors affecting chum salmon spawning at Hardy Creek, Hamilton Springs, and the Ives Island channel should lead to habitat and water management practices that improve conservation of the species.

There are three objectives to achieve the chum salmon monitoring goal. The first objective is to monitor the status of the chum salmon population at the three sites through time. Status can be inferred from estimates of adult and juvenile abundance in conjunction with various attributes of population health, such as population age structure, sex ratio, and various indices of recruitment and survival (e.g., egg-to-emergence survival, spawner-to-smolt production). Strategies to achieve this

objective include: (1) estimate adult abundance using weirs and traps, spawning ground surveys, carcass surveys, and other approved means; (2) estimate abundance of juveniles using trap nets; and (3) characterize biological attributes (i.e., size, sex, age, etc.) of adult and juvenile chum salmon.

The second objective is to identify appropriate population units for conservation. It is uncertain whether chum salmon using the three spawning areas exhibit spawning site fidelity and function independently as reproductive units, or actually consist of a single interdependent unit. Strategies to achieve this objective include examining movements of adult chum salmon among the three spawning areas using radio telemetry of fish tagged at locations in the vicinity of Pierce Refuge.

The third objective is to determine how specific habitat features affect chum salmon status and indices of population health. Strategies to achieve this objective include examining habitat features associated with redds in Hardy Creek and Hamilton Springs, and evaluating the relation of these features to such attributes as estimates of juvenile abundance, survival, and emergence time.

Improvements to Salmonid Artificial Spawning Channel, Pierce Refuge

The Service will maintain the artificial spawning channel at Pierce Refuge and investigate modifications to evaluate its potential to provide spawning habitat for chum salmon. Observations suggest that gradient and water velocity at the lower portion of the spawning channel may

prevent access by chum salmon. Initial investigations are intended to evaluate modifications in the channel (e.g., placement of slotted weirs) to improve fish access. Additional investigations will address factors potentially influencing the attraction of adult chum salmon, their ability to spawn within the channel, and juvenile production. Depending on the results of these investigations, the feasibility of increasing potential spawning habitat by constructing areas with upwelling water from a well source, may be evaluated. Information generated from these investigations is intended to assist in developing restoration approaches that may be applied in other areas to improve production of chum salmon.

Purple Martin Nesting Structures, Steigerwald Lake and Franz Lake Refuges

The Service will continue maintenance of the nest boxes installed to establish a purple martin colony at Steigerwald Lake Refuge. Starting in 1991, the Service has maintained nest structures (boxes and gourds) mounted on poles along the Columbia River Dike Trail (Dike Trail). Nest structures are also placed along the shoreline of the Columbia River between Franz and Arthur Lakes. These nest structures will be managed to accommodate up to 40 nesting pairs. Colony management may require annual removal, cleaning, and winter storage of the nest structures. To avoid utilization by nontarget species, the nest structures may be plugged prior to the arrival of purple martin. Additionally, individual nesting poles may be moved short distances to open areas as riparian communities mature along the Columbia River shoreline.

Air Quality Monitoring, Steigerwald Lake Refuge

The Washington Department of Ecology will continue to operate an air monitoring station at Steigerwald Lake Refuge as part of a larger program to improve current understanding of airborne particulate matter in the Columbia River Gorge National Scenic Area (Scenic Area).

Gateway Center and Interpretive Trail, Steigerwald Lake Refuge

Subject to availability of appropriated funding, the Service will construct a Gateway Center and interpretive trail at Steigerwald Lake Refuge, as described in the Service's Steigerwald Lake Gateway Center EA and Finding of No Significant Impact.⁴⁷ The Gateway Center will contain interior exhibits, an indoor wildlife viewing area, information and sales counters, a conference area, and classroom space. In addition, it will be the headquarters office for the Gorge Refuges. An interpretive kiosk will direct visitors to points of interest in the Scenic Area and to specific locations for other outdoor recreational opportunities. A 2.25-mile trail will lead from the Gateway Center to the Columbia River Dike, providing interpretive stations and views of Refuge wetlands, riparian areas, and the Columbia River. The kiosk, interpretive trail, and support facilities may developed before funding becomes available to construct the Gateway Center. These facilities will serve an estimated 125,000 visitors annually.

Transport of Biosolids Across Dike, Steigerwald Lake Refuge

The City of Washougal sewage treatment plant is located adjacent the Steigerwald Lake Refuge. Tertiary treated biosolids produced at the plant are transported by truck over a Refuge dike, to property belonging to the Port of Camas/Washougal, where they are spread on open fields as fertilizer. This process is repeated approximately two out of every three years. The Service will continue to issue a Special Use Permit to the City of Washougal for use of the dike road. Stipulations will be attached to the permit to reduce the potential for negative impacts to Refuge resources (see Compatibility Determination in Appendix K).

Refuge Inholdings

When a national wildlife refuge is established, the Service defines an acquisition boundary for that refuge. The approved acquisition boundary formally establishes the extent to which the Service may acquire interests in lands to achieve refuge purposes. The acquisition boundary can be modified only by executive order, legislation, or the Service's Director. A Land Protection Plan (LPP) is commonly prepared during detailed planning for a new refuge or for the expansion of an existing refuge. Land protection is the elimination of undesired, incompatible, and usually detrimental impacts to fish and wildlife habitat. Service policy is to acquire the minimum interest in lands necessary to reach its management objectives. Federal

land protection can be accomplished through management of lands acquired by fee acquisition, conservation easement, permit, lease, or cooperative agreement. Land protection may also be provided by local regulatory control such as zoning, ordinances, or regulatory permits. If fee title is required, full consideration is given to extended use reservations, exchanges, or other alternatives that will lessen any impact on the owner and the community. Law requires the Service to offer fair market value when acquiring lands. Donations of desired lands or interests are encouraged.

The original LPP for Franz Lake Refuge was prepared in 1990. An LPP for Franz Lake and Steigerwald Lake Refuges is provided in Appendix L to inform and update landowners and the local interested public of the resource protection needs, the implementation schedule and priorities, and the dimensions of Service management proposals within the existing Refuge boundaries. The land protection priority for this plan is to complete acquisitions within the approved refuge boundaries (i.e., inholdings). Additionally, the Service will continue to coordinate with the U.S. Forest Service in the management or transfer of lands within the approved acquisition boundary of Franz Lake Refuge. The Service does not propose to expand or otherwise alter existing boundaries for these refuges as part of this CCP. Because Pierce Refuge is fully acquired, a LPP was not required for this Refuge.

Alternative A: No Action

Under this Alternative, the Service would continue to protect, maintain, and, where feasible, restore habitat for priority species, including Canada geese, waterfowl and federal and state listed species. However, at current levels of funding and staff, habitat restoration, as well as survey and monitoring, would continue to be inadequate to meet Refuge goals and objectives. The existing distribution of winter browse for Canada geese would be maintained at Steigerwald Lake and Pierce Refuges by mowing, grazing, haying, and burning grasslands. Work to reduce or remove barriers to fish migration within Refuge boundaries would continue. A small amount of riparian forest and scrub-shrub would be restored under this alternative, with emphasis on connecting existing forest fragments and buffering fish-bearing streams. Wetland management would continue to focus on reducing reed canarygrass through seasonal flooding and tillage. Existing wetland impoundments at Steigerwald Lake Refuge would be maintained pending results of the COE feasibility study. Existing oak habitat would be protected but not expanded. Efforts to control established infestations of invasive and noxious plants and nonnative animals would continue to occur.

Construction of the Gateway Center and interpretive trail at Steigerwald Lake Refuge was approved through a separate planning process in 1999. Under this alternative, as in Alternatives B and C, it is assumed that the center will be constructed and portions of this Refuge would be officially opened to

the public within the next 15 years, subject to the availability of appropriated funds. Consistent with the decision we made in 1999, horseback riding, dog-walking, jogging and bicycling would be discontinued along the east 0.6-mile section of the Dike Trail to provide high-quality wildlife viewing and interpretation.⁴⁷ Essential staff for operation of the Gateway Center would be hired. Addition of these staff to the one currently funded position for the Gorge Refuges (Refuge Manager), would allow the Service to substantially improve the public use program. At Steigerwald Lake Refuge, opportunities for wildlife viewing and photography and environmental education and interpretation would be expanded, and visitation would increase. Opportunities for the public to attend special events and staff-led tours would continue at all three Gorge Refuges. Pierce Refuge would be available to local school groups for environmental education. Once the Gateway Center is constructed, Steigerwald Lake Refuge would become the primary destination for school groups.

Goal 1: Protect, Restore, and Enhance the Natural Diversity of Floodplain, Upland Forests, and Grassland Habitats Representative of the Lower Columbia River Ecosystem.

Objective A1.1 - Emergent Wetland

Steigerwald Lake Refuge: The Service will maintain and enhance 207 acres of emergent wetland to reduce reed canarygrass and promote native short and tall emergent plant species.

Pierce Refuge: The Service will maintain approximately nine acres of emergent wetland within Pierce Lake, Pierce Pond, Domestic Spring Pond, and Lena's Lake to reduce reed canarygrass and promote native short and tall emergent plant species.

Rationale: Wetlands provide important stopover, feeding, and breeding habitat to migratory waterfowl and shorebirds. They also provide critical breeding, rearing, and feeding habitat for native fish and wildlife including a number of threatened and endangered species. Approximately 80 percent of bird species listed as sensitive in Oregon or Washington occur in riparian and wetland habitats.³¹ Most amphibians require aquatic habitat for part of their life cycle. The northwestern salamander and western toad, conservation targets for the Gorge Refuges, breed in ponds and backwaters. The western pond turtle, another conservation target, is a riparian and wetland obligate species. In addition, wetlands perform important hydrologic functions including flood control, erosion and storm damage reduction, water quality maintenance, and water supply.

Over the last century, more than half of the historic wetlands of the lower Columbia River have been lost to diking, draining, filling, dredging, and flow regulation.^{42,43} Virtually all wetlands remaining on the Columbia River have been degraded by human activities to some degree, and most are dominated by invasive, nonnative vegetation. Reed canarygrass has completely displaced native wetland communities such as Columbia sedge marsh and tufted hairgrass prairie.⁹ In these monocultures, wetland plants other than

canarygrass comprise less than one percent of the total vegetation.³⁴ Because of significant concerns for the conservation and management of freshwater wetlands, the WDFW lists emergent wetlands as a Priority Habitat. Similarly, wetland restoration and protection is a top priority for the Lower Columbia River Estuary Partnership.²⁹

Strategies:

- Mow accessible areas supporting a dense cover of reed canarygrass in late summer when ground surface is capable of supporting heavy equipment.
- Use large tillage equipment (48-inch disk plates) in the mowed areas to cut dense sod layer. Repeat treatment several times, as needed; allow rhizomes of reed canarygrass to desiccate between treatments.
- Where water control is possible, flood reed canarygrass to a depth of at least 18 inches (preferably 24 to 36 inches) until July. Drain the water after the canarygrass growing season is over to allow native moist soil plants to germinate. See Appendix M for additional water management guidelines.

Objective A1.2 - Riparian Bottomland Forest

Within the next 15 years, the Service will restore 73 acres of riparian forest at Steigerwald Lake Refuge and Pierce Refuge to connect forest fragments and to buffer fish-bearing streams.

Rationale: Over 90 percent of the original riparian bottomland forest along the Columbia River has been lost to inundation by dams or conversion to agriculture.⁴⁴ Land use practices within the watersheds of the Gorge Refuges have reduced and

fragmented riparian areas and surrounding forested uplands.

Riparian areas adjoining salmon bearing waterways should be restored to sufficient widths and structural complexity to achieve a full array of beneficial ecological functions. Portions of Refuge watersheds have inadequate riparian vegetation to prevent excessive solar heating. The Service's CRFPO has identified a severe shortage of large woody debris input to the Gibbons Creek watershed.⁵ This shortage leads to a lack of structural diversity for fish spawning and rearing. Wood debris also benefits channel stability by dissipating and redirecting erosional forces of water.

Strategies:

- Plant approximately 73 acres of riparian forest along Refuge streams, with at least five locally grown native tree and shrub species.
- Implement prescribed burning per Fire Management Plan (Appendix N).

Objective A1.3 - Riparian Scrub-Shrub

During the life of the CCP, the Service will maintain existing riparian scrub-shrub vegetation on Steigerwald Lake and Pierce Refuges (30 acres and 7 acres, respectively). Restoration along anadromous fish corridors on these Refuges will provide an additional 8 acres of habitat.

Rationale: Riparian scrub-shrub habitat has been greatly reduced in the lower Columbia River by diking and draining of wetlands. Remaining scrub-shrub vegetation is infested with nonnative reed canarygrass.

Strategies: Plant native willow, spirea, and other riparian shrubs grown from local native stock along embankments of salmon-bearing streams.

Objective A1.4 - Oak Woodland

The Service will protect 65 acres of existing oak woodland at Steigerwald Lake(40 acres) and Pierce (25 acres) Refuges. Oak woodlands will exhibit a mean stand-level canopy closure of 40 to 80 percent, with Oregon white oak contributing at least 50 percent of the canopy cover.^{3,28}

Rationale: Oregon white oak communities are declining in extent and condition.⁸ Many of the species closely associated with oak habitats are of conservation concern (Appendix D), including western gray squirrel, Lewis' woodpecker, white-breasted nuthatch, streaked horned lark, western meadowlark, Oregon vesper sparrow, western pond turtle, white-topped aster, golden paintbrush, common buttercup, and rose checker mallow.¹³

The current extent of Steigerwald Lake and Pierce Refuges oak woodlands is approximately 42 and 27 acres, respectively. The oak community at Steigerwald Lake is a rare association in the Pacific Northwest. The Oregon white oak /oval-leaved viburnum - poison oak community is listed as Globally Critical (G1) by the Washington Natural Heritage Program. The oaks at Steigerwald Lake are part of a contiguous oak community extending 400 acres to the north and east of the Refuge. This is the largest oak community in the region.

Along the edges of the oak woodlands and among small, disjunct stands of oak, invasive plants have displaced native understory species. Nonnative species, particularly Himalayan blackberry, suppress natural regeneration of oak seedlings, thereby threatening the long term viability of oak communities.

Strategies:

- Implement a “no net loss” policy of oak habitat on the Gorge Refuges.
- Remove nonnative blackberry from the understory within 20 acres of oak habitat at Steigerwald Lake Refuge utilizing a combination of mechanical and herbicide treatments.

Objective A1.5 - Oak Savanna

During the life of the CCP, the Service will protect three acres of existing oak savanna on Pierce Refuge. This habitat will exhibit mean stand-level canopy closure of less than 25 percent, with oak contributing more than 50 percent of the canopy; predominantly herbaceous ground cover (grasses and forbs); and interspersed of native shrub cover.³

Rationale: Native grasslands and oak communities are among the most imperiled ecosystems in western Washington.¹³ Native grasslands, such as those found in the understory of oak savanna, have declined to less than three percent of their presettlement areal extent in the south Puget Sound area.¹¹ The presettlement extent of oak habitat on the three Gorge Refuges is poorly documented. At Steigerwald Lake, oaks near the Stevenson homestead were cleared for construction of State Route 14.⁶ The

remaining mature oaks occupy soil types extending from above the historic floodplain of Steigerwald Lake to State Route 14. This distribution would suggest that Oregon white oak at Steigerwald was more abundant prior to agricultural development. Similarly, at Pierce Refuge the land was systematically cleared for pasture. The current interspersed of relict oaks and upland pastures would suggest that Oregon white oak was among the habitats cleared for ranching. With oaks occurring predominately outside the floodplain, oak habitat may have been especially vulnerable to conversion to pasture.

Strategies:

- Implement a “no net loss” policy of oak habitat on the Gorge Refuges.
- Remove nonnative vegetation from the understory within open-canopy oak stands utilizing a combination of mechanical and chemical treatments.
- Implement prescribed burning per Fire Management Plan (Appendix N).

Objective A1.6 - Grasslands (Managed Field and Old Field)

During the life of the CCP, the Service will manage about 36 acres on Pierce Refuge and 295 acres on Steigerwald Lake Refuge in short (3 to 6 inches tall) perennial grass to provide winter forage for Canada geese. Approximately 96 acres of grassland on Pierce Refuge and 105 acres of grassland on Steigerwald Lake Refuge will be maintained as old field (unmowed open field) to provide habitat for native grassland species, function as transportation corridors for wildlife, and buffer adjoining habitats.

Rationale: Migrating and wintering Canada geese, other geese and some ducks, such as American wigeon, forage extensively on actively-growing annual vegetation. Haying, mowing and grazing help to maintain grass and some forbs in a suitable condition for waterfowl.

Winter is the primary season of use by Canada geese at Steigerwald Lake and Pierce Refuges. Historic surveys from 1975 through 1987 documented up to 450 Canada geese wintering at Steigerwald Lake Refuge. The predominant subspecies noted during the 1987 surveys were western and Taverner's Canada geese, with significant observations of three dusky Canada geese and 15 cackling geese. During the early 1990's, cackling Canada geese largely shifted wintering range from the central valley of California to western Oregon and southwestern Washington.⁴¹ At the same time, the population size of cacklers was also increasing. This resulted in a corresponding increase in Canada geese using Steigerwald Lake Refuge. The average number of wintering geese counted between 1998 and 2003 was 857, with a range of 491 to 1,485. At the same time, the composition of Canada goose flocks using the Refuge had increased to approximately 77 percent cacklers. Through 2003, dusky Canada goose observations have continued to be low, with most of the observations occurring in February and March of 1999 with 10 or less duskys. Although duskys continue to be observed on an occasional basis, the Refuge appears to be located outside the primary dusky wintering range.

Steigerwald Lake Refuge currently provides about 290 acres of goose foraging habitat. Observations by Service biologists indicate that the number of acres of managed field at Steigerwald Lake Refuge exceeds current levels of use by wintering geese. Some areas not used by geese can be maintained as old fields without negatively impacting the local population of Canada geese.

Wintering Canada goose use at Pierce Refuge has not been monitored. Infrequent observations during the 1990s suggest that 100 to 300 geese used the Refuge on an irregular basis. Goose use has declined in recent times to only a few sightings of small (less than 25 geese) flocks. This decline coincided with a reduction of available goose browse due to a lack of staff to maintain the fields in short grass.

Strategies:

- Maintain quality goose browse and control noxious weeds through the use of haying, mowing, re-seeding, fertilization, and herbicide spraying.
- Grazing may be utilized at Steigerwald Lake Refuge per the Compatibility Determination (Appendix K).
- Implement burning per Fire Management Plan (Appendix N).
- Follow these guidelines for managing grasslands:
 - Reduce vegetation height within managed fields to 3 to 6 inches prior to October 15th.
 - Hay and mow managed fields after June 15 per Compatibility Determination (Appendix K).

- ▶ Limit management activities within old fields throughout the year.
- ▶ Minimize herbicide spraying and fertilization between May 1 and July 15.

Goal 2: Protect and Enhance Populations of Native Flora and Fauna with an Emphasis on State- and Federally-listed Threatened and Endangered Species, Species of Conservation Concern, and Their Habitats.

Objective A2.1 - Inventory and Monitoring Program

The Service will develop and maintain an inventory and monitoring program for the Gorge Refuges to determine baseline populations, trends, and habitat associations for State listed species, Service trust species, and the conservation target species listed in the CCP.

Rationale: The scientific basis for wildlife and habitat management at a given site is a thorough knowledge and understanding of the resources and natural processes present or formerly present at that site. Although acquired approximately 15 years ago, the Service has only been able to conduct a few biological surveys (other than salmonid-related activities) to assess the natural resources of each Refuge. This lack of data hinders the Service's efforts to develop effective management strategies and to assess the efficacy of management activities or other actions on trust resources. Likewise, the role of each Refuge and its importance to specific resources within the context of the lower Columbia River landscape can only be speculated.

Acquiring a more thorough knowledge of fish and wildlife populations and habitats will enable the Refuges' management staff to identify critical management needs and species of importance. This will allow the Service to better address and meet regional needs and goals.

Strategies:

- Continue bi-monthly winter surveys of Canada geese at Steigerwald Lake Refuge to determine population trends, identify habitat utilization patterns, and support regional monitoring programs.
- Support and coordinate salmon monitoring and studies by the Service's CRFPO and partners at Pierce Refuge.

Objective A2.2 - Fisheries

The Service, working with partners and Refuge neighbors, will improve access to known spawning and rearing habitat for native fish in the watersheds of the Gorge Refuges. Through the removal or modification of in-stream blockages to fish passage, this objective will improve access to about 5.9 miles of habitat in the Gibbons Creek watershed, 1.8 miles of habitat in the Indian Mary Creek watershed, and 1.2 miles of habitat in the Hardy Creek watershed.

Rationale: The watersheds draining the Gorge Refuges provide spawning and rearing habitat for several species of anadromous fish that are listed or candidates for listing under the Endangered Species Act (see Chapter 4). Anadromous fish must have unobstructed passage to enable adults to reach their spawning grounds within the constraints of a limited amount of bodily energy. Physical structures that impede fish passage, such as culverts, dams or weirs, can

result in reduced numbers or eventual extirpation of local salmonid populations.

To develop this objective, data on fish habitat barriers was obtained from two primary sources: (1) surveys of the Gibbons Creek watershed,⁵⁵ and (2) the WDFW website, SalmonScape.⁵⁰

The water diversion structure on Gibbons Creek at Steigerwald Lake Refuge partially blocks fish migration at high flows. SalmonScape defines a partial blockage as “conditions blocking a certain species or life stage of a given species to upstream migration.”⁵⁰ At high flows, gravel is deposited at the Gibbons Creek diversion structure, and debris accumulates on the screens. This results in water being diverted into the old Gibbons Creek channel much more frequently than originally planned. Fish are transported into the wetlands with the overflow, where they have little chance of survival.⁵ Removal or modification of this blockage would improve access to about 5.9 miles of habitat for anadromous fish, up to the next partial blockage on Campen Creek, and the complete blockage on Gibbons Creek. A complete blockage occurs when conditions prevent all species and life stages of salmon from completing their upstream migration.

There is a partial blockage to fish passage at Franz Lake Refuge in Indian Mary Creek at the Burlington Northern railroad culvert. Removing or modifying the culvert would improve access for anadromous fish to approximately 1.8 miles of habitat. About 1.5 miles (83 percent) of this habitat is north of State Route 14. The WDFW database

indicates this stream segment has the "presumed presence" of steelhead.

Two elevated culverts on Hardy Creek at Pierce Refuge (one at the Burlington Northern railroad crossing and the other at State Route 14) completely block anadromous fish migration. Replacement or modification of the culverts would provide anadromous fish with access to 1.2 miles of potential spawning and rearing habitat.

Strategies: Assess man-made migration barriers (e.g., culverts) within the approved Refuge acquisition boundary and coordinate with landowners for subsequent removal or modification.

Objective A2.3 - Columbia Yellowcress

During the life of the plan, the Service will facilitate partners to monitor Columbia yellowcress at Pierce Refuge to improve information on habitat and population trends.

Rationale: The State has listed Columbia yellowcress as a Threatened plant species with a distribution in Washington limited to the shoreline of the Columbia River along the Hanford Reach and downstream of Bonneville Dam near Pierce Refuge. Herbarium samples indicate that prior to construction of dams on the Columbia River, the species was more widespread. The population at Pierce Refuge is considered to be the largest remaining population in the Columbia River watershed; most other populations in the lower Columbia River are relatively small, typically with fewer than 500 specimens and sometimes only several plants.^{14,22}

Specific habitat requirements for this plant, as well as the long-term viability of the Pierce population, are not well understood.^{12,23} Sedimentation and establishment of competing woody plants, primarily false indigo bush, in the previously sparsely-vegetated cobble system threaten Columbia yellowcress.^{9,22} The population at Pierce Refuge should continue to be monitored to refine habitat parameters and detect population trends.

Strategies:

- Allow access through and on Pierce Refuge for monitoring Columbia yellowcress and removal of competing shrubs by approved Service partners.
- Restrict public access from known and viable Columbia yellowcress habitat (i.e., shoreline).

Goal 3: Reduce the Impacts of Nonnative and Invasive Species on Native Flora and Fauna.

Objective A3.1 - Noxious and Invasive Plants

The Service will minimize the extent and abundance of noxious and invasive plants on the Refuges, as measured by acres of infested habitat, severity of infestation, numbers of noxious and invasive species, and estimated population size.

Rationale: Certain species of plants pose an economic threat to surrounding farm and pasture lands, and are designated as noxious weeds by state or county authorities. The Refuge is legally required to control noxious weeds and will continue to work with local authorities to use the most environmentally-benign treatments available. Canada thistle

is the most common noxious weed in the Gorge Refuges, it occurs in varying levels of infestation throughout much of the upland Refuge habitat.

Other invasive plant species, although not designated as noxious weeds, displace native plant communities, reducing habitat diversity and habitat values for native wildlife species. On the Gorge Refuges, Himalayan blackberry and reed canarygrass are among the most abundant terrestrial invasive plant species. In some areas, these species have displaced native shrubs, grasses and forbs to form dense monocultures. In forest habitat, they reduce forest structure and prevent native understory species from becoming established. Oak and riparian communities have been impacted by limited recruitment of saplings. In Refuge wetlands, reed canarygrass has degraded the floristic composition of emergent vegetation. False indigo-bush and Japanese knotweed have the potential to negatively impact riparian communities and salmonid habitat. The abundance of these invasive species inhibit the Refuges from accomplishing its primary goals and objectives.

Strategies: In addition to the habitat restoration and management objectives under goal 1, which include measures to control invasive species:

- Use volunteers to survey and map key noxious and invasive plant populations on Steigerwald Lake and Pierce Refuges once every 5 to 10 years, and develop a GIS database.
- Educate Refuge field staff and Service partners about the potential for new invasive species of plants that may

become established on the Gorge Refuges.

Objective A3.2 - Nonnative Fish and Wildlife

The Service will monitor and reduce the population and expansion of established invasive fish and wildlife species negatively impacting species of conservation concern or their habitats on the Gorge Refuges.

Rationale: Several species of nonnative wildlife hinder the Service's efforts to achieve Refuge goals and objectives. Approximately 50 percent of the fish found within the Columbia River system are nonnative species. The true impacts of these species are unknown. However, one species, carp, are known to destroy wetland vegetation and cause increased turbidity, which renders sites unsuitable for native species of fish and wildlife.

Bullfrogs may eliminate native species of amphibians and reptiles through competition for food resources, aggressive displacement, and predation. Bullfrogs prey on juvenile western pond turtles.³³ Field studies at Conboy Lake Refuge have found that, seasonally, 25 percent of a female bullfrog diet may consist of other native frogs. Other native species eaten by bullfrogs include salamanders, garter snakes, voles, and innumerable invertebrates.

Nutria, a wetland dwelling rodent, is known to displace native muskrats, destroy large quantities of aquatic vegetation and dig burrows into dikes and roadways. Their excavations can result in structural failures, causing significant human safety concerns

and reducing water management capabilities.

Strategies:

- Maintain screens on Pierce Lake to exclude carp from entering the wetlands.
- As needed, drain Pierce Lake and remove nonnative fish and bullfrog tadpoles. Time treatments to avoid impacting production of native amphibians and reptiles.
- Modify areas frequented by nutria to render them less suitable for the species.

Goal 4: Provide Management-based Research Opportunities and Conduct Refuge Studies to Investigate Ecosystem Dynamics, Wildlife and Habitat Relationships, Habitat Use Patterns, and Human Impacts.

Objective A4.1 - Identify High Priority Research Needs

Within three years, the Service will develop a list of high priority research and study needs to fulfill the Gorge Refuge's vision, goals, and objectives.

Rationale: Management and public use activities on natural lands require a working knowledge of the wildlife, fish, and plant species present and each species' contribution and importance to the ecosystem. This knowledge, coupled with landscape functions, regional priorities, and environmental compliance standards, should dictate the management direction and techniques necessary to effectively manage Refuge lands.

Management activities combine a variety of proven and experimental techniques. Many of the techniques have a known specific benefit to a narrow range of target species or habitats. Impacts to nontarget species or effects on the overall function and ecology of the landscape are rarely understood. As the fields of conservation biology, ecosystem management, and habitat restoration continue to produce new information, new questions arise regarding the environmental impacts of standard management techniques and priorities. Likewise, regional demographics, social tolerances and expectations, land development, and nonnative species apply continual pressures to develop adaptive management strategies on refuges and other natural lands.

It is imperative for refuges to collect site-specific data, conduct defensible research, and utilize new information to adapt management practices for the long-term benefit of both refuge and non-refuge resources. The number of potential studies and research projects is endless. Identifying high priority management-oriented research projects is paramount to allocating and directing funds and staffing.

Strategies:

- Conduct a Wildlife and Habitat Management Review utilizing regional experts to assess Refuge management programs and identify research needs and opportunities.
- Develop a list of priority research and study needs and make the list available to the Service, other agencies, and research institutions upon request.

Goal 5: Develop and Encourage Public Understanding of and Support for the Purposes and Visions of Steigerwald Lake, Franz Lake, and Pierce National Wildlife Refuges.

Objective A5.1 - Public Outreach

The Service will continue existing outreach programs that inform the public about the Gorge Refuges.

Rationale: Outreach programs are an effective tool in educating the public about how refuges enhance natural resources, improve water quality, and provide educational and economic benefits to local communities. When the public knows and understands these qualities of the Gorge Refuges, they will be more likely to support them.

Strategies:

- Participate annually in three outreach events on or off the Gorge Refuges.
- Develop a brochure and website for the Gorge Refuges.

Objective A5.2 - Environmental Education

Provide a location for educators to conduct environmental education activities.

Rationale: Environmental education is identified in the National Wildlife Refuge System Improvement Act as one of six priority public uses of the system. The Gorge Refuges provide a desirable setting for teaching environmental concepts, conducting research, and for studying native flora and fauna. Through a well developed and executed environmental education program, the Gorge Refuges can play a role in the education of elementary to college

students, as well as adults enrolled in continuing education programs.

Strategies:

- Authorize non-Service organizations (e.g., WolfTree) and Service programs (e.g., CRFPO) to lead environmental education activities at Pierce Refuge for up to 180 students per year.
- Provide educators with teaching resources and guidance for Refuge field trips and in- classroom activities.

Objective A5.3 - Develop a Refuge Interpretation Program

Develop an interpretive program that communicates to visitors the importance of Gorge Refuge habitats and their management to the lower Columbia River. Include information about visitor opportunities in the Scenic Area.

Rationale: Because the Gorge Refuges are the best example of remaining natural floodplain habitats in the Columbia River Gorge, it is important that the public understand the benefits of protecting these areas. An interesting and educational interpretive program will deliver key Refuge messages. It will evoke an understanding and appreciation of the Refuges and National Wildlife Refuge System, as well.

Strategies:

- Construct the Steigerwald Gateway Center and develop an interpretive program.
- Develop the interpretive trail from the Gateway Center to the Columbia River Dike.⁴⁷

- Update interpretive panels at the Franz Lake overlook.

Objective A5.4 - Columbia River Dike Trail

The Service will implement the decision described in the Gateway Center Environmental Assessment to construct an interpretive trail for wildlife observation, wildlife photography, interpretation, and environmental education at Steigerwald Lake Refuge.⁴⁷ When construction of the interpretive trail has been completed, close the interpretive trail, including the segment on the Columbia Dike, to non-wildlife-dependent uses, including dog walking, bicycling, horseback riding, and jogging.

Rationale: In 1999, an Environmental Assessment was prepared to address the construction of the Steigerwald Gateway Center and the establishment of wildlife-dependent recreational uses at Steigerwald Lake Refuge.⁴⁷ After public review, the alternative selected included construction of the Gateway Center and a two-mile accessible interpretive trail starting at the Gateway Center, with an access point for pedestrians on the Dike Trail. Evocative educational interpretive displays and features would be developed along all portions of this trail. In an effort to minimize user group conflicts and to provide a high quality resource based experience, the trail segment located on the Dike Trail would be reserved for compatible wildlife-dependent recreation (excluding hunting). Incompatible or non-wildlife-dependent public uses including dog walking, bicycling, horseback riding, and jogging, would not be permitted beyond the junction of the interpretive trail and the Dike Trail.

Strategies: Officially open a 2.5-mile trail on Steigerwald Lake Refuge to wildlife-dependent uses, and close east 0.6-mile

segment of trail to horseback riding, bicycling, dog walking, and jogging. Monitor use to ensure compatibility.

Figure 3-1. Steigerwald Lake Alt A.

Figure 3-2. Franz Lake Alt A.

Figure 3-3: Pierce Alt. A

Alternative B: Proposed Action

Alternative B, the preferred alternative, would focus Refuge management on restoring and maintaining biological diversity, with particular emphasis on the conservation targets identified in the CCP. Inventory, monitoring, and research would increase. Working with partners, the Service would seek to remove blockages to fish passage within the Gibbons Creek, Indian Mary Creek and Hardy Creek watersheds. The Service would participate in ongoing efforts to cleanup Gibbons Creek and to eliminate the threat of contaminated groundwater and stormwater runoff from entering Steigerwald Lake Refuge. Substantially more acreage would be targeted for restoration under this Alternative than under Alternative A. The Service would initiate actions to detect new invasions of nonnative species on the Gorge Refuges, track established invaders, and implement a coordinated program of containment, control, and habitat restoration.

Opportunities for wildlife viewing, wildlife photography, environmental education, and interpretation would increase. In addition to the current wildlife-dependent public uses of the Dike Trail, the Service would officially open the portion of the trail on Steigerwald Lake Refuge to horseback riding, jogging, bicycling, and leashed pets. The Refuge would increase the number of staff-led tours, and partner with the city of North Bonneville to promote wildlife viewing from an existing trail adjacent to Pierce Refuge. Environmental education would be enhanced through coordination with local school teachers, and classroom visits.

Goal 1: Protect, Restore, and Enhance the Natural Diversity of Floodplain, Upland Forest, and Grassland Habitats Representative of the Lower Columbia River Ecosystem.

Objective B1.1 - Emergent Wetland

Steigerwald Lake Refuge: Restore, enhance, and maintain up to 237 acres of emergent wetland habitat within Steigerwald Lake, Redtail Lake, and Scaup Pond for waterbirds and other conservation targets.

Franz Lake Refuge: Investigate and implement restoration on approximately 42 acres of seasonal wetland along the south shore of Franz Lake and in the swale east of the Refuge entrance road for waterbirds and other conservation targets.

Pierce Refuge: Restore, enhance, and maintain approximately 11 acres of emergent wetland within Pierce Lake, Pierce Pond, Domestic Springs, Lena's Lake, and South Slough for conservation targets..

All Refuges: Target conditions for emergent wetlands include the following:

- Reed canarygrass would cover less than 40 percent of emergent wetland habitat.
- Greater than 40 percent cover of at least 10 genera of native or desirable nonnative, short and tall emergent plants (composition determined July-September at maturity of emergent plants).

Rationale (in addition to rationale for Objective A1.1): Dense, persistent stands of nonnative reed canarygrass dominate the

wetlands at Steigerwald Lake and exclude desirable native plants. Despite recent improvements to water control features at Domestic and Lena's Lakes, native aquatic vegetation is sparse within wetland impoundments at Pierce Refuge. The lack of water control and appropriate equipment for treating reed canarygrass infested wetlands, as well as insufficient staff, has prevented attempts at wetland restoration on Franz Lake Refuge.

Successful restoration of wetland systems from reed canarygrass commonly involves removing or reducing reed canarygrass to provide suitable conditions for native wetland plants to become established. Reed canarygrass rhizomes, dead stems, and leaves can form a sod layer measuring over 1.5-feet thick. A variety of methods have been attempted for reed canarygrass control, with a combination of management strategies applied over several years generally yielding the best results.³⁰ The methods proposed are intended to both reduce reed canarygrass and increase native plant composition. Soil disturbance in combination with herbicide spraying and flooding are proven techniques to reduce reed canarygrass from Columbia River while enhancing native species.³⁴ The lack of water control at Franz Lake Refuge will require the Service to experiment with various combinations of approved treatment methods. Most importantly, adaptive management will be necessary to update annual work plans based on results of previous management actions.

Strategies (in addition to strategies for Objective A1.1):

- Use adaptive management to restore

wetlands currently infested with reed canarygrass. Initiate treatment with mechanical control methods, including mowing, disking (tilling), and scraping. Combine these treatments with approved herbicides (e.g., Rodeo, Aquamaster) where and when necessary to kill reed canarygrass rhizomes. Implementation details will be provided in a step-down Integrated Pest Management Plan to be completed after the CCP has been approved (See Chapter 6). Continue monitoring and follow-up treatments every year for at least five years or as needed to prevent reinvasion.

- Where seasonal flooding can be used in combination with mechanical and chemical treatments to control reed canarygrass, apply the Wetland Management Guidelines in this CCP (Appendix M).
- Explore options to construct a spillway on Pierce Lake to establish maximum allowable water depth.
- Recontour Lena's Lake to support emergent wetland vegetation.
- Assess the water control structure on the Franz Lake entrance road to determine if it needs to be reset for improved drainage and to prevent entrapment of juvenile salmonids. Also, recontour the swale east of the structure to improve hydrology and reduce reed canarygrass.

Objective B1.2 - Riparian Bottomland Forest

Over the next 15 years, the Service will maintain 219 acres of existing riparian forest on the Gorge Refuges and will restore an additional 198 acres of historic riparian bottomland forest at Steigerwald Lake Refuge (122-acre habitat expansion) and Pierce Refuge (76-acre habitat expansion) to

provide habitat for a diversity of native wildlife and plants and to shade salmon-bearing streams. When fully restored, riparian forest will exhibit the following conditions.^{3,28}

- Patch or corridor width will equal or exceed 100 feet.
- Native tree and shrub species diversity to include at least five locally grown native species.
- Buffer areas consisting of unmowed grass and shrubs will be two to three times as wide as the height of riparian stand.
- Greater than 40 percent sub-canopy closure (subcanopy is greater than 12 feet and below the canopy foliage).
- Shrub layer (less than 12 feet tall) cover greater than 50 percent with greater than 60 percent of that cover composed of native shrubs and small saplings.
- Canopy closure will exceed 50 percent.
- Maintain or establish one riparian forest stand contiguous with adjacent public lands on both Pierce and Franz Lake Refuges, with a minimum stand size of 100 acres each, with a possible combination of riparian forest and scrub-shrub, as long as the stands are contiguous.

Rationale: Over 90 percent of the original riparian habitat along the Columbia River has been lost to inundation by dams or conversion to agriculture.⁴⁴ There are no known high-quality occurrences of native ash communities remaining downstream of the Bonneville Dam.⁹ Remnant native riparian forest has been degraded by invasive plants. In particular, reed

canarygrass dominates floodplain habitats, limiting native seed germination and shading any seedlings that manage to germinate. Another invasive species, Himalayan blackberry, dominates the shrub layer within many riparian communities.

Neotropical migratory bird conservation in the western United States will require the protection and restoration of riparian woodlands.⁷ Riparian habitats support 67 of the 118 (57 percent) neotropical migrant species in Washington.⁴ Avian density in riparian forest along the Columbia River can be as high as 1,500 birds per 100 acres.³⁹ Approximately 85 percent of Washington's terrestrial vertebrate species use riparian habitat for essential life activities.⁴⁰

In a contiguous form, intact riparian areas function as connectors and travel corridors for terrestrial wildlife.¹⁹ Reductions in riparian corridor width decreases suitability of the habitat for some species and may increase encroachment of nest predators and nest parasites to the interior of the stand. Large stands (greater than 100 acres) of structurally diverse riparian bottomland forest can provide essential habitat for area-sensitive species such as yellow-billed cuckoo.³ Formerly an abundant or common breeder on the lower Columbia River, the cuckoo is considered extirpated from Oregon and Washington.²⁶ Some suitable habitat remains along the lower Columbia River and elsewhere in the Willamette Valley and Puget Lowlands. Restoration of riparian forest contiguous with adjacent lands would increase availability of habitat for yellow-billed cuckoo.

Strategies:

- Plant at least five species of locally grown native trees and shrubs on approximately 198 acres of historic habitat (currently degraded riparian habitat and nonnative grasslands).
- Control invasive species with weed mats and herbicide applications.
- Manage vegetation with scraping, disking, and mowing.
- Implement burning per Fire Management Plan (Appendix N).

Objective B1.3 - Riparian Scrub-Shrub

Steigerwald Lake and Pierce Refuges: Over the next 15 years, the Service will provide approximately 123 acres of high-quality riparian scrub-shrub habitat at Steigerwald Lake Refuge (101 acres) and Pierce Refuge (22 acres) for a diversity of native wildlife and plants and to shade salmon-bearing streams

Franz Lake Refuge: Over the next 15 years, the Service will increase the native shrub layer by at least 10 percent on 45 acres (minimum) to 95 acres (maximum), of existing riparian scrub-shrub habitat at Franz Lake Refuge for a diversity of native wildlife and plants, and to shade salmon-bearing streams.

All Refuges: High-quality riparian scrub-shrub habitat is defined as:³

- Patch or corridor will equal or exceed 100 feet wide.
- Restored habitat will connect to other riparian communities and aquatic environments.
- Native tree and shrub species diversity will include at least five species.

- Native shrub layer will consist of 30 to 80 percent cover (shrub layer is woody vegetation 3 to 12 feet tall) with scattered herbaceous openings.
- Canopy tree cover will not exceed 20 percent (canopy trees are woody vegetation over 12 feet tall).

Rationale (in addition to rationale for Objective A1.3): Supplemental planting with appropriate scrub-shrub species within existing stands of riparian scrub-shrub will improve habitat structure. Management activities will reduce reed canarygrass to provide appropriate substrate for native seed fall and planting activities. At Steigerwald Lake Refuge, opportunities to develop and maintain localized hydrology compatible with scrub-shrub habitats will be explored. This may require manipulating the overflow channel at the Gibbons Creek diversion structure to include meanders and topographic barriers designed to improve soil saturation and support scrub-shrub communities. The small drainage west of the sewage treatment facility will be improved by de-channelization and installation of a water control structure to better manipulate hydrological conditions for riparian scrub-shrub vegetation.

Strategies:

- Plant at least five locally grown native trees and shrub species.
- Control invasive species with weed mats and herbicide applications.
- Manage vegetation with scraping, disking, mowing.
- Implement burning per Fire Management Plan (Appendix N).

- At Steigerwald Lake Refuge, improve existing interior berm west of sewage treatment facility to provide appropriate hydrology for establishment of native riparian scrub-shrub vegetation.

Objective B1.4 - Oak Woodland

During the life of the CCP, the Service will maintain existing oak woodland habitat at Steigerwald Lake Refuge (41 acres) and Pierce Refuge (27 acres) in the following condition.^{3,28}

- The mean stand-level canopy closure will be 40 to 80 percent.
- Oregon white oak will comprise over 50 percent of canopy cover.
- Less than 10 percent of the canopy will be conifers.
- Native shrub understory will exceed 40 percent cover.
- Himalayan blackberry and other nonnative shrubs will not exceed 10 percent cover.

Rationale (in addition to rationale for Objective A1.4): Oregon white oak woodlands are among the most imperiled ecosystems in western Washington.¹³ Unlike many other threatened habitat types, oak habitat in Washington is transitional and requires active management.²⁸ Oregon white oak is typically a subclimax species with Douglas fir growing three to five times faster in shared habitat west of the Cascades.³⁸ Historically, frequent low-intensity fires prevented the establishment and maturation of Douglas firs within Oregon white oak habitat. Periodic fire may have killed some Oregon white oak; however, this process is essential to promote oak regeneration and enhance stand structure complexity. With the cessation of

regular burning 100 to 130 years ago, many grasslands and savannas became dense oak woodlands, which in turn were overtaken by conifers.¹ Fire suppression has resulted in an increase in the distribution and cover of coniferous trees such as Douglas-fir.²⁰

Strategies:

- Replace lost canopy trees within woodlands with oak saplings to maintain canopy criteria.
- Control invasive plants with weed mats and spot herbicide spraying.
- Manually remove conifer seedlings and mature conifers, as needed, and nonnative ornamental plant species by cutting or girdling.
- Implement the Fire Management Plan (Appendix N) to achieve specific management objectives for oak woodlands. Use adaptive management practices to evaluate the response of oak communities to prescribed fire and adjust the prescriptions accordingly. Time burns to avoid impacting bird nesting season and seasonal movements of western pond turtle. Post fire treatment may involve seeding the understory with native forbs and grasses and limited weed control.

Objective B1.5 - Oak Savanna

Over the next 15 years, the Service will reduce cover of nonnative plants to less than 10 percent on 2 acres of existing open-canopy oaks at Pierce Refuge and will initiate restoration of oak savanna on approximately 106 acres of existing grassland at Steigerwald Lake (93 acres) and Pierce Refuges (11 acres). Full restoration to an oak savanna community is anticipated to require over 50 years to achieve. When

fully restored, mean stand-level tree canopy closure will not exceed 25 percent with Oregon white oak contributing over 50 percent of the canopy.³ Restoration of oak savanna in managed/old fields will provide a transitional upland prairie habitat exhibiting the following characteristics.^{2,3}

- Native upland prairie vegetation (e.g., native fescues, tufted hairgrass, and native forbs) will exceed 20 percent ground cover.
- Maintain variable grass height less than 30 inches during bird nesting periods.
- Retained a mosaic of fallow/native grasses in over 25 acre blocks during the nesting season.
- Maintain an interspersed of native shrub cover from 10 to 40 percent with nonnative shrubs contributing less than 10 percent.

Rationale: One of the most notable changes in the vegetation of western Washington and Oregon since settlement has been the near extirpation of native grasslands and savanna. Over 90 percent of pre-settlement prairie in the Puget Trough has been lost to urban development, forest invasion and conversion, and agricultural uses.²⁴ The tufted hair-grass prairie is now extremely rare or extirpated along the Columbia River.⁹

Oaks historically occurred over a larger area of Pierce and Steigerwald Lake Refuges than they do today. Much of the lands now part of the Refuges were cleared of trees or shrubs and sown to pasture grasses. Today, the Refuge mows or hays these fields to provide goose browse. Plant and animal diversity in these intensively managed fields

is unknown, but are likely far less than occurred in the habitats they displaced.

Breeding bird diversity in native dry prairie is high, exceeding wet prairie, and includes such grassland obligate species as western meadowlark, Oregon vesper sparrow, streaked horned lark, and grasshopper sparrow. Upland prairie can provide nesting sites for western pond turtle and foraging habitat for the brush prairie pocket gopher, both conservation targets. Upland prairie supports a wide variety of native plant species, including several listed species.⁵¹

Strategies:

- Reseed or inter-seed oak stands and plantings with native understory species.
- Plant oak saplings interspersed within restored prairies.
- Control invasive plants with herbicides and fire, when oaks mature to over 50 years, (See Fire Management Plan, Appendix N).
- Restore and maintain upland prairie conditions by tilling, fertilizing, mowing, and controlled burns, when mature (Appendix N).

Objective B1.6 - Grasslands (Managed and Old Field)

Over the next 15 years, the Service will maintain 23 acres and 168 acres on Pierce and Steigerwald Lake Refuges, respectively, in short (3 to 6 inches tall), perennial grass to provide winter forage for Canada geese. Approximately 44 acres of grassland at Pierce Refuge and 71 acres of grassland at Steigerwald Lake Refuge will be maintained as old field (unmowed, open field) to provide nesting and foraging habitat,

function as wildlife transportation corridors, and buffer adjoining habitats.

Rationale: Historic land use practices prior to establishment of the Gorge Refuges included livestock and dairy production. To increase agricultural values, portions of the landscape were cleared of trees and shrubs. Grazing practices expanded the grasslands, which became favored winter browse for Canada geese.

Wildlife Refuges are vitally important wintering areas for Canada geese. Pierce and Steigerwald Lake Refuges provide considerable goose food resources, and human activity (disturbance) is usually regulated. Continued and improved monitoring of Refuge grassland use by Canada geese will delineate high use areas. Some areas not utilized by wintering waterfowl will be managed as old fields, to be restored to the historic vegetation cover. Invasive plants within old fields will be occasionally reduced; however, treatment of old fields will be less frequent than managed fields. Old fields will provide important habitat for ground dwelling species while buffering adjacent native plant communities from managed fields.

Strategies (in addition to strategies for Objective A1.6):

- Identify and manage primary use areas for wintering Canada geese.
- Plan and implement controlled burns according to the Fire Management Plan (Appendix N), both within managed fields and within old fields, to reduce

invasive species and provide quality winter browse for Canada geese.

Objective B1.7 - Wet Meadow

Within 15 years, the Service will test and then apply proven techniques for wet meadow restoration on 20 acres of historic wet meadow habitat currently infested with reed canarygrass on the Gorge Refuges. When fully restored, these habitats will support high native plant species richness (6 to 12 species) and low percent cover (less than 30 percent) of reed canarygrass.

Rationale: Native wet meadows have all but disappeared from the Columbia Basin floodplain due to stabilization of water regimes, drainage for agricultural and other purposes, and invasion of nonnative species of plants. Reed canarygrass has completely displaced some native wetland communities including the Columbia sedge marsh and tufted hairgrass prairie.⁹ In seasonal wetlands, plant species other than canarygrass can comprise less than one percent of the total vegetation.³⁴ In contrast, wet meadows with low or moderate amounts of canarygrass are dominated primarily by native species.¹⁰

Restoration techniques for Columbia River wet meadows are not well studied or have generally met with limited success due to changes in hydrologic conditions and the presence of reed canarygrass. This objective will evaluate various restoration techniques on one-acre “study plots” and apply the results to larger areas (up to 20 acres) of the Gorge Refuges.

Strategies: Test restoration techniques on five acres at Steigerwald Lake Refuge and apply the most effective techniques to the restoration of an additional 20 acres of historic wet meadow on the Gorge Refuges. Adaptive management will include disking (tilling), mowing, cutting, scraping, digging, shade cloth, mulching, fire, chemical (herbicide), and seasonal inundation. Both passive restoration (relying on remnant seedbank) and active restoration will be tested. Treatment will occur over a two to three-year period with follow-up treatments for 5 to 10 years to prevent reinvasion of reed canarygrass.

Objective B1.8 - Service Roads

During the life of the CCP, the Service will reduce wildlife disturbance and improve habitat values on Pierce Refuge by closing approximately 1.5 to 2.0 miles of infrequently used and unnecessary road segments.

Rationale: Pierce Refuge is transected by approximately 3.3 miles of administrative roads. Although many of these roads are needed for management, duplicate or infrequently used roads can be closed to reduce habitat fragmentation and wildlife disturbance. Vehicles, equipment, and personnel traveling these roads are potential carriers of invasive plants. Mowing and other activities intended to maintain these roads may disperse invasive plants. In general, it is prudent to reduce roads to the minimum extent necessary to support Refuge goals and objectives.

Strategies:

- Limit vehicular access to approved (mapped) roads.

- Convert appropriate sections of closed roads to foot paths (for authorized uses).
- Disk, recontour, and plant grass in rutted or graveled sections of closed roads.

Goal 2: Protect and Enhance Populations of Native Flora and Fauna with an Emphasis on State- and Federally-listed Threatened and Endangered Species, Species of Conservation Concern, and Their Habitats.

Objective B2.1 - Inventory and Monitoring Program

The Service will develop and maintain an inventory and monitoring program for the Gorge Refuges to determine baseline populations, trends, and habitat associations for trust species and the conservation target species listed in the CCP.

Rationale (in addition to rationale for Objective A2.1): The Refuge System Improvement Act requires the Service to monitor the status and trends of fish, wildlife, and plants on refuges. Staffing and budget limitations necessitate a priority system to guide these efforts. Priorities for the Gorge Refuges would include the conservation targets identified in the CCP (Appendix D), including federal-listed and State-listed species. Monitoring data would be used to evaluate whether management actions and restoration efforts are achieving the stated objectives. Acquiring a more thorough knowledge of fish and wildlife populations and habitats will enable Refuge staff to identify critical management needs and additional species of importance at each site. This will allow the Refuge to better address and meet regional species needs and goals.

Strategies: Same as Objective A2.1, with the following additions:

- Expand Canada goose surveys to include Pierce and Franz Lake Refuges.
- Conduct avian point counts on a five year cycle at Franz Lake and Pierce Refuges.
- Develop and implement Refuge-specific inventory and monitoring programs for trust wildlife species and conservation targets..

Objective B2.2 - Fisheries

The Service, working with partners and landowners, will improve existing access and open up new access to known and potential spawning and rearing habitat for native fish in the watersheds of the Columbia Gorge Refuges. Through the removal or modification of blockages to fish passage, located both on and off the Refuges, this objective will provide new or improved access to about 10.2 miles of habitat in the Gibbons Creek watershed, 1.8 miles of habitat in the Indian Mary Creek watershed, and 1.2 miles of habitat in the Hardy Creek watershed.

Rationale: The federal government (including the Service) has spent over \$7.5 million at Steigerwald Lake Refuge to acquire land, construct an elevated fish passage channel and ladder, and reroute Gibbons Creek through these structures to meet the objective of unrestricted fish passage through the Refuge.⁵ Despite these efforts, the water diversion structure creates a partial barrier to successful fish migration, especially at high flows. Removal or modification of the structure, as proposed in Alternative A, would improve fish access to

the watershed; however, there would remain two partial blockages and five complete blockages (culverts) to fish passage upstream from the Refuge. SalmonScape defines “partial blockage” as conditions preventing a species or life stages of a species of salmon to complete its upstream migration. A “complete blockage” occurs when all life stages of all fish species are fully blocked to upstream migration.⁵⁰ Partial blockages on Campen Creek impede access to about 0.9 miles of fish habitat (up to a complete blockage). Culverts on Campen and Gibbons Creeks block 4.3 miles of stream to fish migrations, including very high quality habitat upstream of the Hans Nagel culvert on Gibbons Creek.⁵

Salmonid production in the Gibbons Creek watershed is far lower than would be expected from a watershed of this size.⁵ A number of factors are believed to be negatively impacting the aquatic ecosystem: (1) habitat fragmentation, especially by road culverts; (2) riparian vegetation removal; (3) in stream habitat simplification by large woody debris input reduction and removal; and (4) spawning habitat degradation by heavy inputs of fine sediment. Next to protecting good habitats where they exist, the Service’s highest priority recommendation for improving salmonid production in the Gibbons Creek watershed is to remove barriers to habitat currently unavailable to anadromous fish.⁵ Removing or modifying all partial and complete blockages throughout the Gibbons Creek watershed would improve access or open up new access to about 10.2 miles of habitat for anadromous fish.

Two elevated culverts on Hardy Creek at Pierce Refuge (one at the Burlington Northern railroad crossing and the other at State Route 14) completely block anadromous fish habitat. Replacing or modifying the culverts would provide anadromous fish with access to 1.2 miles of potential spawning and rearing habitat.

Strategies:

- Assess man-made migration barriers (e.g., road and railroad culverts) within the Gibbons Creek, Indian Mary Creek, and Hardy Creek watersheds for subsequent removal or modification.
- Develop partnerships with private landowners, agencies, organizations, and local communities to accomplish stream improvement projects within these watersheds where they would benefit native fish.
- Coordinate management of Refuge fisheries with the Service's CRFPO and appropriate agencies. Initiate annual coordination meetings with the CRFPO, and maintain contact with other agencies.

Objective B2.3 - Columbia Yellowcress

Objective same as listed under Objective A2.3.

Rationale: Rationale same as listed under Objective A2.3.

Strategies (in addition to strategies listed under Objective A2.3 include the following):

- Develop agreements, as necessary, with agencies and organizations to coordinate and facilitate improved monitoring, management, and protection of Columbia yellowcress populations and habitat.

Objective B2.4 - Water Quality

Steigerwald Lake Refuge: Working with partners, (1) monitor and reduce the level of fecal coliform bacteria, nutrients, turbidity, and temperature in Gibbons Creek flows entering Steigerwald Lake Refuge, (2) reduce or eliminate the threat of contaminated groundwater and stormwater runoff from industrial facilities entering Steigerwald Lake Refuge, and (3) determine the level of risk associated with contaminants found in sediments of the Gibbons Creek remnant channel.

Pierce Refuge: The Service will monitor total suspended solids as a measure of turbidity, and work towards reducing the turbidity in water flowing into Hardy Creek from Pierce Lake and after the Creek's passage under a railroad car bridge downstream from the Pierce Lake outflow. The turbidity flowing out of Pierce Lake will be reduced to meet Washington state water quality standards, not exceeding 5 nephelometric turbidity units (NTU) when the background turbidity (Grenia Creek) is 50 NTU or less.

Rationale: The Refuge System Improvement Act directs the Secretary of the Interior to "assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the System and the purposes of each refuge."

Gibbons Creek is currently on the Clean Water Act section 303(d) list as a water quality limited waterbody for fecal coliform bacteria based on Washington State Department of Ecology (WDOE) data.¹⁶ In addition to high fecal coliform bacteria counts, Gibbons Creek exhibits higher than

normal levels of nutrients (phosphorus and nitrate), turbidity, and temperature.¹⁶ The Service has recorded similarly high water temperatures (equal or exceeding 60°F) in the watershed during summer months.⁵

There is no single source of pollution to Gibbons Creek. Non-point sources of pollution may include failing septic tanks, agricultural waste, sediments from construction sites, and stormwater runoff from rooftops, driveways, roads, and lawns. Loss of riparian vegetation and lack of large woody debris along many sections of Gibbons Creek and its tributaries contributes to high water temperature, accelerated erosion, and turbidity. The WDOE has developed a Detailed Implementation Plan for cleaning up Gibbons Creek.

Water quality in the remnant channel, formed by rerouting Gibbons Creek in 1992, is another concern for the Refuge. This channel, located on the Steigerwald Lake Refuge, receives wastewater from five industrial facilities, in addition to stormwater runoff from many more facilities. Water samples collected from the remnant channel in 1994 and 1995, exceeded State water quality criteria for pH, temperature, fecal coliform, turbidity, and dissolved oxygen.¹⁷ Samples collected from the storm sewer also violated criteria for pH, hexavalent chromium, total chromium, copper, zinc, and arsenic. Organic compounds were detected at low levels in the remnant channel, although no compounds exceeded Environmental Protection Agency (EPA) criteria for aquatic

life effects. Metal concentrations in sediment samples in the lower channel were elevated for arsenic, chromium, copper, zinc, cadmium, and lead.

The WDOE is responsible for permitting the facilities on the Camas/Washougal Industrial Park as well as for oversight of cleanup efforts at Burlington Environmental. It is in the best interest of the Refuge Manager to maintain close coordination with WDOE to encourage continued progress on their efforts to remediate the site and protect the Refuge for fish and wildlife.

Pierce Lake on Pierce Refuge has had a shallow water depth and mostly muddy bottom for many years. It is not known whether inflow water from Grenia Creek is the current source of sediment transport into Pierce. It may be that a beaver dam at the confluence of Grenia Creek and Pierce Lake may cause deposition of sediments prior to water entering Pierce Lake. Heavy winter wind movement throughout the Gorge keeps the silts suspended, so they flow out of the lake much of the winter. The silts settle out when the water reaches the slower portion of Hardy Creek, partially covering the spawning redds of chum salmon.

Strategies:

Steigerwald Lake Refuge

- Assist WDOE with implementing the Gibbons Creek Detailed Implementation Plan, particularly the monitoring and public education components.
- Develop and implement a Water Quality Monitoring Plan for Steigerwald Lake

Refuge by 2005. In addition to monitoring water quality, the plan will include measures to regularly monitor stream flows and water elevations of Gibbons Creek on the Refuge.

- Assist partners with organizing and training volunteers to monitor water quality. Coordinate monitoring efforts with volunteers from Washington State's Monitoring Resource Center for Clark County.
- Integrate water quality assessments and improvements with the COE feasibility study at Steigerwald Lake Refuge.
- Encourage WDOE to continue working with facilities at the Port of Camas/Washougal Industrial Park to implement the monitoring and remediation identified in the Gibbons Creek Remnant Channel Receiving Water Study.¹⁷
- Conduct a risk assessment of contaminated sediments in the Gibbons Creek Remnant Channel to determine appropriate actions.

Pierce Refuge

- Organize volunteers and coordinate training for monitor water quality monitoring.
- Evaluate turbidity levels flowing into and out of Pierce Lake to determine the source of outflow water turbidity.
- Restore, enhance, and maintain emergent wetland vegetation as described in Objective B1.1 - Emergent Wetland.
- Evaluate actions such as the use of trees and shrubs as windbreaks around Pierce Lake, and the use of large woody debris within the lake, placed at 90 degrees to the prevailing winds. This will also provide fish habitat.

- Construct a “splashdown” pool with a large rock bottom to reduce erosion occurring at the outlet from the Pierce Lake culvert, followed by a series of settling ponds to facilitate settling of sediments before the Pierce Lake water reaches Hardy Creek.

Goal 3: Reduce the Impacts of Nonnative and Invasive Species on Native Flora and Fauna.

Objective B3.1 - Noxious and Invasive Plants

Objective same as listed under Objective A3.1.

Rationale: Rationale same as listed under Objective A3.1.

Strategies (in addition to habitat treatments identified in goal 1 include the following):

- Survey and map noxious and invasive plants on the Gorge Refuges at least once every five years, using a standardized classification system and consistent methodology.
- Develop a GIS system to map and track existing invasive plant infestations.
- Design and implement a monitoring protocol to measure the effects of management actions on invasive plants and modify treatments as necessary.
- Support research on the ecology and control of nonnative plants to help prioritize and guide management actions on the Refuges (Supports goal 4).
- Coordinate and facilitate removal (i.e., provide logistical support) of key invasive plants (e.g., false indigo bush) within Columbia yellowcress habitat.

Objective B3.2 - Invasive Fish and Wildlife
Objective same as listed under Objective A3.2.

Rationale: Rationale same as listed under Objective A3.2.

Strategies (in addition to strategies listed under Objective A3.2 include the following):

- Periodically drain and remove nonnative bullfrogs and fish from Lena's Lake and Domestic Springs Pond (in addition to Pierce Lake).
- Coordinate surveys by Refuge and CRFPO personnel, to monitor areas of permanent and semi-permanent water for invasive fish and wildlife at least once every five years.

Objective B3.3 - Identify and Assess Threats
Within five years, the Service will identify nonnative and invasive species on the Gorge Refuges and assess threats imposed by these species to Refuge resources.

Rationale: The impacts of nonnative invasive wildlife and plants are considered to be one of the most critical issues facing natural lands and waterways. Nonnative species can cause havoc within ecosystems by displacing, out-competing, or preying on native species. Although many of the following species are not currently found on the Gorge Refuges, nonnative species can cause economic turmoil when they infest certified seed or destroy valuable food crops (thistle, dodder), kill trees (gypsy moth, wood borer), dominate pasture lands (spurge, cheat grass), cause mechanical failures in water diversion systems (zebra mussels), or inhibit water transportation (water hyacinth, Eurasian water-milfoil).

In 1998, the battle against invasive species cost the Refuge System an estimated \$12.7 million.⁴⁸ Today, the backlog of known Service-wide invasive projects has increased to more than \$150 million. Literally hundreds of nonnative species inhabit the Pacific Northwest. However, not all nonnative species pose the same level of threat and not all species can be effectively controlled. Therefore, it is important to identify the species and infestations on a Refuge that pose the most significant threats. This information is critical to determining the tactical order of priority for treatment of invasive species, particularly when confronted with established populations of multiple species.

Strategies: Conduct a Wildlife and Habitat Management Review, or other appropriate forum, to assist the Gorge Refuge staff in evaluating threats from invasive species, establishing a monitoring protocol, determining treatment priorities, and identifying appropriate control measures.

Objective B3.4 - New Invasive and Noxious Species

Prevent the introduction and spread of new invasive plant, fish, and wildlife species to the Gorge Refuges from external sources.

Rationale: An estimated 5,000 plant species have been introduced into natural ecosystems within the United States, compared to a total of 17,000 species of native U.S. plants.³⁵ In a growing world economy with increased international trade and travel, invasive species are more likely to spread from their indigenous habitats to new locations around the globe. The Columbia River and its tributaries serve

as major routes for the introduction and spread of nonnative, invasive, undesirable or nuisance terrestrial and aquatic species. The Gorge Refuges are strategically located on this dispersal route to receive new invaders.

Although it is widely accepted that the most cost effective way to manage invasive species is through prevention, Refuges typically focus their invasive species management activities on the control of established infestations. Preventing invasion of potential invaders should be the highest priority strategy in any Integrated Pest Management plan developed for a natural area. Specific actions to achieve this objective will likely involve surveys, monitoring and public education.⁴⁸

Strategies:

- Develop geospatial models using GIS and invasive species inventories to identify high priority areas on the Gorge Refuges to monitor for early detection and treatment.
- Survey for new invasive plant species and monitor populations of existing invasive fish and wildlife annually.
- Develop a “watch list” of invasive and noxious species for Refuge staff, volunteers, and private landowners.
- Improve the ability of field staff and Service partners to recognize invasive species, including conducting training to improve awareness about the potential for new invasive species.
- Develop and implement a rapid-response protocol for newly detected invasive species on the Gorge Refuges.
- Coordinate with partners, especially bordering federal and private landowners, county governments, universities, and the

research community, to detect and treat invasive species and to inform the public about these efforts.

- Conduct annual reconnaissance for ricefield bulrush on the Gorge Refuges.

Goal 4: Provide Management-based Research Opportunities and Conduct Refuge Studies to Investigate Ecosystem Dynamics, Wildlife and Habitat Relationships, Habitat Use Patterns, and Human Impacts.

Objective B4.1 - Identify High Priority Research

Objective same as listed under Objective A4.1.

Rationale: Rationale same as listed under Objective A4.1.

Strategies (in addition to strategies for Objective A4.1): Implement the top five ranked research projects within 15 years of implementing the CCP.

Objective B4.2 - Research Outreach

Within five years, the Service will develop and implement an Outreach Plan to promote management-based research on the Gorge Refuges.

Rationale: It is particularly important for a refuge with a small land-base to continually evaluate its management program because small refuges tend to be less resilient than larger refuges to the myriad of impacts resulting from human activities occurring within a refuge’s ecosystem. The Gorge Refuges would benefit from partner-sponsored research projects necessary to fully understand the ecological role

and function of the Refuges. Collaboration with universities, independent researchers, other natural land agencies, and foundations is paramount if the Service is to effectively manage and maintain the Gorge Refuges for biological productivity. Given the high competition for natural resource funding and the need for quality studies and research, the Service must market the Gorge Refuges' uniqueness and research needs to the scientific community.

Strategies: The Research Outreach Plan will include the following strategies (additional strategies may be identified):

- Develop a list of potential collaborators to market the Gorge Refuge's research opportunities and needs.
- Describe research needs and opportunities on the Gorge Refuges website (see Objective 5.1) and in a pamphlet.
- Improve communication with potential partners to obtain technical assistance (e.g., provide seasonal employees, internships and volunteers) and funding for research projects.

Objective B4.3 - Research Support

Within five years, the Service will develop and provide the necessary support to facilitate and accomplish management-based research on the Gorge Refuges.

Rationale: The Gorge Refuges staff have recognized the need to utilize non-Refuge personnel to conduct the various surveys, studies, and research necessary to fulfill its purpose, mission, and goals. These personnel may range from local volunteers to foreign country-based researchers. The

Refuges would solicit assistance while providing logistic support and project oversight. In many cases, it is expected that funding proposals and work duties will be cooperative, cost-share efforts. The Refuges must develop a support system to reduce costs to collaborators, thus increasing the potential for attracting high quality individuals.

Strategies:

- Develop or improve existing infrastructure needed to encourage and support research on the Refuges (e.g., storage, lab, office facilities).
- Identify funding sources and application procedures.
- Develop a schedule of in-kind services that the Service can offer to researchers interested in conducting studies on the Gorge Refuges.

Objective B4.4 - Research Partnerships

Within five years, the Service will establish at least five partnerships with universities, institutions, non-government organizations, or government agencies to support and accomplish management-based research and studies.

Rationale: Research project and study needs often occur on a cyclic basis seasonally, annually, or at longer scheduled intervals. These needs may also occur on short notice requiring immediate attention and resolution. Establishing long-term partnerships will expedite the exchange or use of personnel, equipment, facilities, and funds. Long-term partnerships may facilitate funding and allow long-term project planning.

Strategies:

- Establish partnerships to support management-based research and studies.
- Solidify or enhance current intra- and inter-agency research agreements.

Goal 5: Develop and Encourage Public Understanding of and Support for the Purposes and Visions of Steigerwald Lake, Franz Lake, and Pierce National Wildlife Refuges.

Objective B5.1 - Public Outreach

Develop outreach and partnership programs that encourage community support for the Gorge Refuges and the National Wildlife Refuge System.

Rationale: Rationale same as listed under Objective A5.1

Strategies:

- Develop a brochure and maintain a website for the Gorge Refuges.
- Host and/or coordinate three to five outreach events on the Refuges with interested partners (e.g., CRFPO, fish hatcheries, Vancouver Audubon Society, Friends of the Columbia River Gorge) and participate in two additional public events or programs off the Refuges each year.
- Hold one volunteer workday on each Refuge per year.
- Facilitate the development of a Gorge Refuges Friends Group.
- Work with adjoining land management agencies to identify and include the Gorge Refuges in their signs and other public media.
- Place Refuge signs (entrance sign style) on each of the Gorge Refuges where they

can be seen by travelers on State Route 14.

- Deliver key messages (See B5.3) and information to neighboring communities through a bi-annual Gorge Refuges Newsletter.
- Offer Service-led information tours and site visits to professional, government, and private individuals and organizations to help foster communication, partnerships, and networking opportunities.

Objective B5.2 - Environmental Education

Establish a cooperative environmental education program that allows students to understand and become actively involved in Refuge management activities.

Rationale: Rational same as listed under Objective A5.2.

Strategies (in addition to Objective A5.2):

- Establish environmental education plan and program with Service staff, volunteers, and partners that targets local schools and meets state education requirements and curriculum needs.
- Establish and maintain education sites at Steigerwald Lake Refuge and Pierce Refuge to facilitate Refuges' environmental education program.
- Consult with CRFPO to incorporate fisheries information into the Refuges' environmental education program, on and off the Refuge.
- Develop two educator's guides and kits containing curriculum materials and activities identified in the Refuges' environmental education program for loan to educators to use on and off the Refuge.

- Visit local schools to provide an orientation on the Gorge Refuges, the Service, and the Refuge System; giving priority to classes scheduled to visit a Refuge.
- Develop permits or agreements to allow educational organizations to conduct learning programs on the Gorge Refuges.
- Partner with the Environmental Information Cooperative at Washington State University and other education institutions to host and coordinate at least two teacher workshops per year.
- Provide students and scout groups with guidance and when possible, opportunities for community service and hands-on learning projects.
- Coordinate development of a Site Design Plan for Pierce Refuge to help facilitate environmental education activities on this Refuge (e.g., restrooms, parking, all-weather shelter).
- Address safety concerns for the railroad crossing at Pierce Refuge.

Objective B5.3 - Interpretation Program

Develop an interpretive program for the Gorge Refuges that communicates to the public the importance of Refuge habitats and their management to the lower Columbia River. Provide information about visitor opportunities in the Scenic Area. Expand interpretive themes to include Native American culture and early Euro-American settlement and their use of and impacts to natural resources on the Gorge Refuges. Key interpretive themes will include the following:

- Impacts of invasive plants and animals.
- Actions citizens can take to protect and improve water quality (e.g., Gibbons

Creek Cleanup Plan).

- Native habitat and wildlife relationships to hydrology.
- Importance of riparian areas to wildlife and water quality.
- Upland habitats and human manipulations.
- Transportation corridors from Chinookan to early Euro-American.
- Fish story – from Wah-cleh-lah to fishwheels.
- Native American's use of plants for food, shelter, canoes, and clothing.
- Early Euro-American settlers.

Rationale: Rationale same as listed under Objective A5.3.

Strategies (in addition to strategies listed under Objective A5.3):

- Develop interpretive signs at the Steigerwald Lake overlook on State Route 14.
- In cooperation with the Town of North Bonneville, develop wildlife viewing signs on an existing trail near the east boundary of Pierce Refuge.
- When passable, offer a guided kayak and canoe tour of Arthur Lake (Franz Lake Refuge) from the U.S. Forest Service St. Cloud Recreation Area.

Objective B5.4 - Columbia River Dike Trail

Within two years of approving the CCP, the Service will officially open the Dike Trail on Steigerwald Lake Refuge for priority wildlife-dependent public uses (excluding hunting) and a few compatible, non-wildlife-dependent uses. The Service will develop methods of interpretation targeting these uses.

Rationale: The Dike Trail portion of Steigerwald Lake Refuge is not officially open to public uses of any type. The public currently has access to the Dike Trail for many uses, including jogging, bicycling, horseback riding, and dog walking. Even though these uses are not wildlife-dependent, the Service has concluded they are compatible (Appendix K) on the trail section crossing the Refuge. Therefore, the Service will officially open this portion of the Refuge to these public uses. In addition, the Service would include these user groups as target audiences on the trail. Multi-modal safety information would be provided to help minimize conflicts between user groups.

Strategies:

- Officially open Steigerwald Lake Refuge's portion of the Dike Trail to priority wildlife-dependent uses (excluding hunting) and some non-wildlife-dependent but compatible public uses (leashed dog walking, bicycle riding, horseback riding, and jogging). This will include updating the Code of Federal Regulations through issuance of an announcement in the Federal Register, and installation of signs at appropriate locations.
- Monitor public uses to ensure compatibility, pursuant to Compatibility Determinations (see Appendix K).
- Ensure that trail maintenance and cleanup is coordinated and conducted by trail user groups.
- Provide signs and information on the Dike Trail to encourage a safe, high quality experience for all trail users.
- Cooperate with Port of Camas/Washougal and other partners to develop an information kiosk on the Dike Trail at the west entrance to the Refuge.

Figure 3-4: Steigerwald Alt B.

Figure 3-5. Franz Lake Alt B

Figure 3-6. Pierce Alt. B

Alternative C

Alternative C has many features in common with Alternative B. The primary difference is that under Alternative C, the Service would seek to restore more of the historic (pre-Bonneville Dam) vegetation cover. Restoration methods would rely on natural regeneration than on active planting of trees and shrubs. At Pierce Refuge, artificially created wetlands and open water habitat would be reduced and pastures eliminated. The amount of pasture at Steigerwald Lake Refuge would be reduced to the minimum needed to support the current population of wintering Canada geese. The maximum amount of oak restoration would occur under Alternative C. Partnerships would be developed to monitor water quality, remove or modify fish barriers, and control or eliminate noxious weed populations. A Research Natural Area would be established at Franz Lake Refuge.

Public uses would be similar to those proposed in Alternative B, with the exceptions of the classroom visits, teacher workshops, and the wildlife viewing trail adjacent to Pierce Refuge. These public uses would not be developed under Alternative C.

Goal 1: Protect, Restore, and Enhance the Natural Diversity of Floodplain, Upland Forest, and Grassland Habitats Representative of the Lower Columbia River Ecosystem.

Objective C1.1 - Emergent Wetland

Reduce reed canarygrass cover to less than 40 percent and increase cover of at least 10 genera of native emergent plants to more

than 40 percent on 212 acres, 37 acres and 3 acres of existing emergent wetland habitat at Steigerwald Lake, Franz Lake and Pierce Refuges, respectively.

Rationale: Prior to the development of dikes and ponds at Pierce Refuge, emergent vegetation occurred mostly as small patches along creek edges and within overflow basins. Pierce Lake was formed by placing a dike across Grenia Creek. The seasonal wetland in South Hardy Slough was created by plugging the slough's connection to Hamilton Creek. Domestic Springs Pond and Lena's Lake were created by impounding natural springs. At Franz Lake Refuge, construction of a dike and water control structure impounded water in a swale east of the entrance road. This objective would remove all of these water control features on Pierce Refuge and Franz Lake Refuge to restore the historic flow-through hydrology.

The key to restoring Steigerwald Lake's emergent marsh system is to restore water inflow into the Lake. Optimally, Steigerwald Lake will be reconnected to both Gibbons Creek and to the hydrologic processes imposed by the Columbia River. If such options prove infeasible (based on results of COE feasibility study described in Appendix H), additional interior diking may be required to increase wetland capacity while protecting adjoining landowners from flooding.

Strategies:

- Use adaptive management to mimic natural disturbance in wetlands with the objective to reduce reed canarygrass and create a seed bed for native wetland

plants (passive restoration). Initiate treatment with mechanical control methods, including disking (tilling), mowing, and scraping. Follow up these treatments with herbicide application only to the extent necessary to kill reed canarygrass and to prevent re-invasion. Continue monitoring and follow-up treatments every year, as needed.

- Where seasonal flooding can be used in combination with mechanical and chemical treatments to control reed canarygrass, apply the Wetland Management Guidelines in Appendix M.
- Replace the water control structure on the Franz Lake entrance road with an open culvert.
- Following the removal or modification of existing water control structures at Pierce Refuge, restore flow-through hydrology and historic vegetation cover, and improve remaining emergent habitat along stream margins.

Objective C1.2 - Riparian Bottomland Forest

Over the next 15 years, the Service will maintain 219 acres of existing riparian forest on the Gorge Refuges and will restore an additional 169 acres of historic riparian bottomland forest at Steigerwald Lake Refuge (101-acre expansion) and Pierce Refuge (68-acre expansion) to provide habitat for a diversity of native wildlife and plants and to shade salmon-bearing streams. When fully restored, riparian forest will exhibit the following conditions.^{3,27}

- Patch or corridor width equal or greater than 100 feet.
- Native tree and shrub species diversity to include at least five species.

- Buffer areas consisting of tall grass and shrubs should be two to three times as wide as the height of the riparian stand.
- Greater than 40 percent sub-canopy closure (subcanopy is greater than 12 feet and below the canopy foliage).
- Shrub layer (less than 12 feet tall) greater than 50 percent cover, with greater than 60 percent of that cover composed of native shrubs and small saplings.
- Canopy closure greater than 50 percent.
- Maintain or establish one riparian forest stand contiguous with adjacent public lands on both Pierce and Franz Lake Refuges, with a minimum stand size of 100 acres each. A combination of riparian forest and scrub-shrub may occur, as long as the stands are contiguous.

Rationale (in addition to rationale for Objective B1.2): Where drastic change in riverine processes has stopped reproduction of cottonwood or willow forests, active management may be necessary to maintain the historic vegetation.²¹ If the ability to reproduce the beneficial ecological functions of large scale flooding is lacking, mechanical techniques such as scraping and disking the soil surface can simulate the physical disturbance of flooding. In riparian areas, sod and litter removal can promote seedling establishment by removing competitors, increasing available light, removing plant inhibitory compounds, altering water balance, and removing physical barriers to seedfall and seedling growth.¹⁸

Strategies: Mimic natural disturbance events (e.g., scouring) at selected restoration sites using mechanical methods such as scraping and disking to create a seed bed (bare soil) for passive restoration. Herbicide treatment and weed mats (shading) may be used to control invasive plant species within restoration sites. Only a minimal amount of active restoration (planting) will occur. Priority sites for simulating natural disturbance will be within or adjacent to existing riparian forest.

Objective C1.3 - Riparian Scrub-Shrub
Steigerwald Lake and Pierce Refuges: Over the next 15 years, the Service will provide approximately 128 acres of high-quality riparian scrub-shrub habitat at Steigerwald Lake Refuge (110 acres) and Pierce Refuge (18 acres) for a diversity of native wildlife and plants and to shade salmon-bearing streams.

Franz Lake Refuge: Over the next 15 years, the Service will increase the native shrub layer by over 10 percent on 45 acres (minimum) to 95 acres (maximum) of existing riparian scrub-shrub habitat at Franz Lake Refuge for a diversity of native wildlife and plants and to shade salmon-bearing streams.

All Refuges: High-quality riparian scrub-shrub will exhibit the following conditions.

- Patch or corridor width of equal or greater than 100 feet.
- Scrub-shrub will connect riparian communities and/or aquatic environments,
- Native tree and shrub species diversity of at least five species.
- Native shrub layer cover of 30 to 80

percent (shrub layer is woody vegetation 3 to 12 feet tall) with scattered herbaceous openings.

- Canopy tree cover will exceed 20 percent (canopy trees are woody vegetation greater than 12 feet tall).

Rationale: The primary natural disturbance regime for scrub-shrub communities is flooding. Floods can create new surfaces for primary succession, erode existing streambank communities, deposit sediments and nutrients on existing communities and selectively kill species not adapted to a particular duration or intensity of flooding. Dams on the Columbia River and its tributaries have greatly altered the frequency and intensity of bottomland flooding within the lower Columbia River.⁸ Dikes have reduced the floodplain and isolated over one-half of the former floodplain communities from the riverine processes which formed and maintained them. Under the highly altered hydrology, reed canarygrass forms dense monocultures. These monocultures limit bare soil and sunlight needed for germination and growth of native seeds. Sod and litter removal can promote seedling establishment.¹⁸ Mechanical and natural treatments can reduce reed canarygrass to create appropriate substrates for natural seed fall and sapling establishment.¹⁹

Strategies: Mimic natural disturbance events (e.g., scouring) within existing and selected restoration sites using mechanical methods such as scraping and disking to create a seed bed (bare soil) for passive restoration. Herbicide treatment and weed mats (shading) may be used to control invasive plant species within restoration sites. Only a

minimal amount of active restoration (planting) will occur. Priority sites for simulating natural disturbance will be within or adjacent to existing riparian scrub-shrub habitat.

Objective C1.4 - Oak Woodland Objective same as listed under Objective B1.4.

Rationale: Rationale same as listed under Objective B1.4.

Strategies: Same as strategies listed under Objective B1.4

Objective C1.5 - Oak Savanna

Over the next 15 years, the Service will reduce cover of nonnative plants to less than 10 percent on two acres of existing open-canopy oaks at Pierce Refuge and will initiate restoration of oak savanna on approximately 129 acres of existing managed and old field at Steigerwald Lake Refuge (93 acres) and Pierce Refuge (34 acres). Full restoration to an oak savanna community is anticipated to require over 50 years to achieve. When fully restored, mean tree canopy closure will be less than 25 percent, with Oregon white oak contributing more than 50 percent of the canopy.³ Restoration efforts in managed and old fields over the next 15 years will provide a transitional upland prairie habitat with the following characteristics.^{2,3}

- Native upland prairie vegetation (e.g., native fescues, tufted hairgrass, and native forbs.) will comprise more than 20 percent of ground cover.
- Maintain variable grass height of less than 30 inches during bird nesting period.
- Retain a mosaic of fallow and native grasses in blocks of greater than 25-acres.

- Maintain an interspersed of native shrub cover of 10 to 40 percent, with nonnative shrubs not to exceed 10 percent cover.

Rationale (in addition to Objective B.1.5): Aerial photographs of Pierce Refuge taken in 1935, as well as soil maps, indicate the managed field south of Pierce Lake once supported forest cover. Restoring this field to a combination of native grasses, forbs and Oregon white oak would provide important habitat for neotropical migratory birds and native reptiles (e.g., western pond turtle). Currently, the field receives a minor amount of winter use by Canada geese. Abundant foraging habitat for this species would continue to occur during restoration and in other portions of the Refuge, as well as on Columbia River islands adjacent to Pierce Refuge (i.e., Pierce and Ives Islands).

Strategies: Same as strategies listed under Objective B1.5.

Objective C1.6 - Grasslands (Managed and Old Field)

Over the next 15 years, the Service will eliminate managed field at Pierce Refuge and maintain a minimum amount (138 acres) of managed field at Steigerwald Lake Refuge in short (3 to 6 inches tall), perennial grass to provide winter forage for Canada geese.

Old field conditions will be maintained on 47 acres of grassland at Pierce Refuge and 119 acres at Steigerwald Lake Refuge. These old fields will be maintained as unmowed, open fields to provide nesting and foraging habitat, wildlife transportation corridors, and transitional buffers between adjoining habitats.

Rationale: This objective eliminates managed field at Pierce Refuge and reduces managed field at Steigerwald Lake Refuge to the minimum area. This amount of restoration to the historic vegetation cover is the maximum that can be feasibly accomplished within the next 15 years. Depending upon success of restoration of native grasslands and oak savannas, the remaining 138 acres of managed field at Steigerwald Lake Refuge could also eventually be restored. Long-term management of native grasslands, using fire and other vegetation management tools, would continue to provide forage for Canada geese, while also benefitting a wide variety of other native wildlife and plants.

Strategies: Same strategies as listed under Objective B1.6.

Objective C1.7 - Wet Meadow

Objective same as listed under Objective B1.7.

Rationale: Rationale same as listed under Objective B1.7.

Strategies: Same strategies as listed under Objective B1.7, with greater emphasis on the use of passive restoration to repopulate treated areas with native wet meadow plant species and to maintain restored sites over the long-term.

Objective C1.8 - Service Roads

Objective same as listed under Objective B1.8.

Rationale: Rationale same as listed under Objective B1.8.

Strategies: same strategies as listed under Objective B1.8

Goal 2: Protect and Enhance Populations of Native Flora and Fauna with an Emphasis State- and Federally-listed Threatened and Endangered Species, Species of Conservation Concern, and Their Habitats.

Objective C2.1 - Inventory and Monitoring Program

Objective same as listed under Objective B2.1.

Rationale: Rationale same as listed under Objective B2.1.

Strategies: Same strategies as listed under Objective B2.1.

Objective C2.2 - Fisheries

The Service, working with partners and property owners, will improve existing access and open up new access to known and potential spawning and rearing habitat for native fish in the watersheds of the Columbia Gorge Refuges. Through the removal or modification of blockages to fish passage, located both on and off the Refuges, this objective will provide new or improved access to 10.2 miles of habitat in the Gibbons Creek watershed, 1.8 miles of habitat in the Indian Mary Creek watershed, and 1.2 miles of habitat in the Hardy Creek watershed. The Refuge will provide an additional 0.9 miles of habitat at Pierce Refuge for native fish passage and rearing in tributary springs of Hardy Slough and in South Hardy Slough.

Rationale (in addition to rationale for Objective B2.2): Water control structures and the man-made soil plug at the head of South Hardy Slough prevent anadromous fish from accessing historic habitat. Grenia Creek probably supported chum spawning in the past, however, silts have buried spawning beds, and the Pierce Lake water control structure prevents fish access to Grenia Creek. Placing water control structures at Domestic Springs and Lena's Lake has resulted in similar impacts to anadromous fish. Additionally, the man-made soil plug at the junction of South Hardy and Hamilton Sloughs prevents anadromous fish from entering the slough from the Columbia River at high flows. Removing all of these man-made structures and restoring nearly one mile of historic fish spawning, rearing and/or passage habitat would benefit anadromous fish while continuing to provide habitat for other native species of plants and animals.

Strategies (in addition to B2.2 strategies):

- Remove or modify dikes and water control structures on Lena's Lake, Pierce Lake, Pierce Pond, and Domestic Springs at Pierce Refuge to restore native fish access to former habitat; implement restoration of former habitats, as needed, to re-create spawning and/or rearing habitat.
- Assess the feasibility of removing the plug in Pierce Refuge's South Hardy Slough to restore the former connection to Hamilton Slough and the Columbia River and to provide passage, rearing, and spawning habitat for native fish.

Objective C2.3 - Columbia Yellowcress
Objective same as listed under Objective B2.3.

Rationale: Rationale same as listed under Objective B2.3.

Strategies: Same strategies as listed under Objective B2.3.

Objective C2.4 - Water Quality
Objective same as listed under Objective B2.4.

Rationale: Rationale same as listed under Objective B2.4.

Strategies: Same strategies as listed under Objective B2.4, except for construction of the splashdown pool and settling ponds. They would not be needed, as implementation of the strategies in Objective C2.2 above would remove Pierce Lake.

Goal 3: Reduce the Impacts of Nonnative and Invasive Species on Native Flora and Fauna.

Objective C3.1 - Noxious and Invasive Plants
Objective same as listed under Objective B2.1.

Rationale: Rationale same as listed under Objective B3.1.

Strategies: Same strategies as listed under Objective B3.1, plus, assist The Nature Conservancy and other partners with removal of invasive plants within Columbia yellowcress habitat.

Objective C3.2 - Invasive Fish and Wildlife
Objective same as listed under Objective A3.2.

Rationale: Rationale same as listed under Objective A3.2.

Strategies: Same strategies as listed under Objective B3.2, except eliminate or reduce habitat for bullfrogs and carp at Pierce Refuge through removal of water control structures throughout the Refuge and the levee plug from South Hardy Slough.

Objective C3.3 - Identify and Assess Threats
Objective same as listed under Objective B3.3.

Rationale: Rationale same as listed under Objective B3.3.

Strategies: Same strategies as listed under Objective B3.3.

Objective C3.4 - New Invasive and Noxious Species
Objective same as listed under Objective B3.4.

Rationale: Rationale same as listed under Objective B3.4.

Strategies: Same strategies as listed under Objective B3.4.

Goal 4: Provide Management-based Research Opportunities and Conduct Refuge Studies to Investigate Ecosystem Dynamics, Wildlife and Habitat Relationships, Habitat Use Patterns, and Human Impacts.

Objective C4.1 - Identify High Priority Research
Objective same as listed under Objective B4.1.

Rationale: Rationale same as listed under Objective B4.1.

Strategies: Same strategies as listed under Objective B4.1.

Objective C4.2 - Research Outreach
Objective same as listed under Objective B4.2.

Rationale: Rationale same as listed under Objective B4.2.

Strategies: Same strategies as listed under Objective B4.2.

Objective C4.3 - Research Support
Objective same as listed under Objective B4.3.

Rationale: Rationale same as listed under Objective B4.3.

Strategies: Same strategies as listed under Objective B4.3.

Objective C4.4 - Research Partnerships
Objective same as listed under Objective B4.4.

Rationale: Rationale same as listed under Objective B4.4.

Strategies: Same strategies as listed under Objective B4.4.

Objective C4.5 - Establish Franz Lake Research Natural Area

Within 10 years, the Service will establish the 420-acre Franz Lake Research Natural Area (RNA) to preserve endemic lower Columbia River floodplain plant and animal communities in a natural state for research purposes. The RNA boundary will include land and water at Franz Lake Refuge below 40 feet mean sea level (most of the area between the railroad and the Columbia River).

Rationale: The Service establishes RNAs to represent the full array of North American ecosystems; biological communities, habitats, and phenomena; and geological and hydrological formations and conditions (FWS Manual Part 8 RM 10). Franz Lake is one of the last undeveloped floodplain wetland complexes remaining within the 143-mile lower Columbia River. It is the largest remaining wapato, spikerush, and bulrush marsh on the lower Columbia River; all other occurrences of this habitat type are smaller and more impacted by development and invasive species.⁹ The riparian forest bordering Franz Lake contains cottonwoods measuring from six to eight feet in diameter.

The Service also intends for RNAs to secure habitat for vanishing, rare, or restricted species. Franz and Arthur Lakes host four species of anadromous fish currently listed or candidates for listing under the Endangered Species Act. The Service establishes RNAs in “seasonal havens” to study concentrations of native animals. RNAs also function as a vantage point for observing concentrated populations, such as a constricted migration route. Wapato in Franz Lake attracts wintering tundra swans

which can be viewed from a platform next to State Route 14. Franz and Arthur Lakes also shelter out-migrant salmonids during Columbia River spring freshets.

Additionally, the Columbia Gorge is a constricted migration route for species that migrate along either the Cascade Range or between the interior Columbia River basin and the western lowlands and valleys of Oregon and Washington.²⁰

Research Natural Areas serve scientists, resource managers, and the public in a variety of ways. They attract ecological and environmental study, protect typical as well as rare and endangered organisms, function as field laboratories, and serve as genetic reservoirs.¹⁵ Establishing the Franz Lake RNA would highlight the site’s unique scientific value as a baseline for evaluating the effects of historic and ongoing activities in the lower Columbia River floodplain. The Franz Lake RNA would join a system of internationally recognized natural areas. Research, monitoring, and educational opportunities would emphasize endemic biological communities, native habitats, natural processes, and the factors limiting them.

Consistent with Service policy (FWS Manual Part 8 RM 10), management would mimic natural disturbance regimes supporting early succession floodplain vegetative communities. The proposed RNA would extend from the Columbia River up to the 40-foot contour to encompass the entire wetland basin and majority of the riparian habitat surrounding the lakebed.

Strategies:

- Develop a step-down Research Natural Area Management Plan to include management objectives, restrictions, and appropriate management practices to maintain a desired seral stage of early succession floodplain habitats. In the absence of spring freshets and scour, natural disturbance regimes will be simulated.
- Remove permanent physical improvements such as roads, fences, and water control structures to the maximum extent possible.
- Temporary facilities needed for research, such as instruments, may be installed with the approval of the Refuge Manager.

Goal 5: Develop and Encourage Public Understanding of and Support for the Purposes and Visions of Steigerwald Lake, Franz Lake, and Pierce National Wildlife Refuges.

Objective C5.1 - Public Outreach

Objective same as listed under Objective A5.1.

Rationale: Rationale same as listed under Objective A5.1.

Strategies (in addition to B5.1 include the following):

- Host four outreach events on the Gorge Refuges and participate in three additional public events or programs off the Refuges each year.
- Hold two volunteer workdays on each Refuge per year.
- Partner to procure and maintain a traveler information radio station that includes information about the Gorge Refuges.

Objective C5.2 - Environmental Education

Objective same as listed under Objective B5.2.

Rationale: Rationale same as listed under Objective B5.2.

Strategies:

- Establish and maintain environmental education sites at Pierce Refuge and Steigerwald Lake Refuge.
- Provide bus parking and portable toilets at Pierce Refuge.
- Address safety concerns for railroad crossing at Pierce Refuge.
- Develop two educational kits containing curriculum materials and activities identified in the Refuges' environmental education program for loan to educators to use on or off the Refuge.
- Develop self-guided indoor classroom programs.

Objective C5.3 - Interpretation Program

Objective same as listed under Objective A5.3.

Rationale: Rationale same as listed under Objective A5.3.

Strategies (same strategies as listed in Objective B5.3 except for the following):

- Do not develop a wildlife viewing trail along the east boundary of Pierce Refuge.
- Develop a virtual tour of the Gorge Refuges on the Refuge Complex website that includes interpretive text and graphics of Refuge wildlife and habitats.

Objective C5.4 - Columbia River Dike Trail

Objective same as listed under Objective B5.4.

Rationale: Rationale same as listed under Objective B5.4.

Strategies: Same strategies as listed under Objective B5.4.

Figure 3-7. Steigerwald Alt C

Figure 3-8. Franz Lake Alt C

Figure 3-9. Pierce Alt C.

Alternative Components Considered but Eliminated from Detailed Analysis

Proposal to Construct a Chum Spawning Channel at Lena's Lake, Pierce Refuge

During development of the CCP, the Service and the COE evaluated a proposal to construct a second spawning channel for chum salmon at Pierce Refuge. The proposed channel west of Lena's Lake would be supplied by spring water diverted through a culvert under the railroad tracks. Examination of this proposal identified the following three major issues: (1) absence of upwelling in the channel would likely preclude chum salmon from selecting it for spawning; (2) possible inability of the channel to transport sediments from backwater events could negatively affect spawning substrate and increase the need for periodic maintenance; and (3) channel elevations would require steps, which chum salmon would have difficulty ascending. Due to the uncertainty of the proposed project to provide high quality spawning habitat for chum salmon, this project was eliminated from further study.

Reintroduction of Columbia White-tailed Deer

Criteria to downlist the Columbia River population of Columbia white-tailed deer (CWTD) require maintenance of at least three viable subpopulations in secure habitat.⁴⁵ The Gorge Refuges are within the historic range of CWTD which extended from the mouth of the Columbia River upstream to approximately The Dalles, Oregon, at river mile 191. The nearest

existing CWTD population to the Gorge Refuges (Wallace Island) is at least 75 miles downstream, and the Vancouver metropolitan area would further hinder or prevent movement between these subpopulations. Releasing CWTD at the Gorge Refuges, if successful, would likely create a geographically and genetically isolated subpopulation. The Gorge Refuges could provide suitable habitat for CWTD in the future; however, additional release sites between the Refuges and the existing population would be necessary.

Grazing, Franz Lake Refuge

Grazing has been suggested as a strategy to manage reed canarygrass to reduce habitat suitability for mosquitoes along the Franz Lake shoreline. The Service discontinued cattle grazing at Franz Lake Refuge in 1995, based on the recommendations of a Grazing Review. The Review determined that grazing had degraded habitat for native wildlife and plants and was not a justified method for managing vegetation. This finding was consistent with other studies reporting significant loss of riparian habitat and water quality.^{36,37,40}

There is little conclusive evidence that grazing is an effective management technique for reducing mosquitoes. Environmental factors, primarily involving flooding and temperature, are known to affect mosquito production, and these ecological processes are outside Refuge control. Grazing as a strategy to reduce shoreline vegetation can only be accomplished after flood waters have receded and soils are sufficiently dry to prevent cows from negatively impacting

riparian areas. Grazing would reduce vegetation after the primary season for mosquito production is over. Furthermore, regrowth of grass would occur before or during the next mosquito breeding season.

Opening Gorge Refuges to Fishing

Based on a thorough evaluation of opportunities for fishing on the Refuges, we determined a fishing program was not warranted. Steigerwald Lake Refuge does not provide quality opportunities for salmonid fishing. Spawning coho, steelhead, and cutthroat utilize Gibbons Creek as passage to spawning sites off-Refuge but do not reside in the creek year-round. Sturgeon do not occur in Refuge waters. The seasonal nature of Steigerwald Lake does not support a significant fish population.

Pierce Refuge is bisected by Hardy Creek, which supports one of the last remaining spawning runs of federally-listed chum salmon. Salmon, steelhead, and cutthroat trout are not present within the Refuge's portion of Hardy Creek outside of the spawning season. Fishing access would likely impact spawning behavior or destroy chum salmon spawning redds. Sturgeon do not occur on the refuge. Very limited warm-water fisheries may occur, but the few lakes are seasonal and managed to preclude warm-water fish. Further, the WDFW has an ongoing program to establish a western pond turtle population in these lakes. Public access to the Columbia River shoreline for fishing would impact the most significant population of the state-listed Columbia yellowcress remaining in western Washington and Oregon.

The Service has an easement to cross private property to access Franz Lake Refuge for official purposes. This is the only road access to Franz Lake and the adjoining Columbia River shoreline. To accommodate public use on Franz Lake, the Service would need to secure a new easement or acquire additional properties to construct a public roadway. Neither option is currently available to the Service.

In addition to concerns for public access and protecting trust species, it was determined that a fishing program on the Gorge Refuges would not materially enhance existing angling opportunities in the area. Public access to the Columbia River for fishing is readily available in the vicinity of the Gorge Refuges. Between the city of Washougal and Bonneville Dam, a distance of about 22 river miles, there are at least 10 locations offering public access to the Columbia River (see Table 4-13). These sites not only offer easy and direct access to the river for fishing, but most provide boat launches, docks, restrooms, fishing information, and trailer parking. Opening the Gorge Refuges to fishing without developing these sorts of support facilities would not enhance existing angling opportunities in the Columbia River Gorge.

Opening Gorge Refuges to Waterfowl Hunting

The Service considered opportunities to open the Gorge Refuges to waterfowl hunting and evaluated the anticipated effects of public hunting to refuge resources, management goals and objectives, and the purposes for each Refuge. This analysis is

contained in Appendix E of the draft CCP/EA and summarized below.

Pierce Refuge was established when Mrs. Lena Pierce donated 319 acres to the Service for "wildlife refuge, recreation or park purposes" (warranty deed). The donor requested that the Service administer the Refuge as an inviolate sanctuary and stipulated that hunting should not be allowed.⁴⁶ Consistent with Refuge purposes and the wishes of the donor, the Service does not propose to open Pierce Refuge to public hunting.

The Service does not propose to open Franz Lake Refuge to waterfowl hunting. The existing road easement onto this Refuge is restricted to administrative and management purposes. Boat access onto the Refuge from the Columbia River during the hunting season would be unreliable and unsafe and may exacerbate the existing bank erosion problem. Moreover, allowing hunting on the Refuge's wetlands would significantly reduce sanctuary habitat for swans and other waterfowl in the lower Columbia River.

The Service does not propose to open Steigerwald Lake Refuge to waterfowl hunting at this time. The hunting area would be centered on the Refuge's highest quality wetland and open-water habitat and would overlay primary use areas for Canada geese. Given the small size (1,049 acres) and configuration of Refuge habitats, little viable sanctuary could be offered in conjunction with a hunt program. Waterfowl would most likely disperse from the Refuge into marginal habitats or onto off-Refuge sites. This displacement would have significant energetic costs to these

waterfowl and would likely result in long term displacement of waterfowl from the Refuge. Canada geese that leave the Refuge may cause agricultural depredation problems on surrounding private lands. The Service does not control all of lands within the approved acquisition boundary for Steigerwald Lake Refuge. Should the Refuge become fully acquired in the future, the Service would re-evaluate opportunities for the public use program at Steigerwald Lake Refuge, including a reassessment of a waterfowl hunting program.

Opening Pierce and Franz Lake Refuges to Public Access

Pierce Refuge and Franz Lake Refuge are not officially open to the public and there are no trails on these Refuges. We do not propose to open the Refuges to the general public; however, under the proposed action, the number of special events, guided tours, and environmental education opportunities would increase. Vehicular access to Franz Lake Refuge is restricted to Refuge staff for administrative and management purposes only, by an easement with the current landowner. Although this prevents Public access by land, the possibility of providing guided kayak tours on areas of the Refuge from the Columbia River will be investigated. Factors such as water elevations and blockages need to be examined. Should the Service eventually acquire the remaining private lands within the approved boundary of Franz Lake Refuge, developing a viewing area and short trail that would be open to the public would be considered (see Land Protection Plan, Appendix L).

Opening Pierce Refuge to the general public would not result in a substantial improvement in recreational opportunities in the area. This is a small Refuge, with very limited possibilities for developing facilities necessary to support a quality, compatible public use program. Moreover, public use would negatively impact efforts by the WDFW to establish a population of the State-listed western pond turtle at Pierce Refuge and may endanger one of the few remaining populations of Columbia yellowcress. Refuge staff also have concerns about opening Pierce Refuge to the general public on a daily basis because of the lack of a safe access to and from State Route 14, and the lack of protected public crossing over the railroad tracks. There are excellent trails and public facilities nearby at Beacon Rock State Park, Hamilton Mountain, Dog Mountain, and North Bonneville. In the future, development of Doetsch Ranch State Park adjoining Pierce Refuge will provide a wide variety of recreational opportunities.

Opening Public Access to the Straub Dike, Steigerwald Lake Refuge

Opening the Straub Dike on the Steigerwald Lake Refuge to public use was considered but eliminated from detailed analysis due to concerns for wildlife disturbance and habitat fragmentation. Along with the Gateway Center, an interpretive trail is planned along the elevated side of the Gibbons Creek channel to connect the future Gateway Center with the Dike Trail. Development of additional public use corridors bisecting the Steigerwald Lake basin would both fragment sanctuary areas and jeopardize wildlife values of the wetland. By

controlling the number, location, and timing of public access to interior portions of Steigerwald Lake Refuge, wildlife and habitat disturbance can be maintained at acceptable and appropriate levels.

Opening Boat Access to Gorge Refuges from the Columbia River

Boat ramps, docks, and facilities have been developed in the vicinity of the Gorge Refuges at Parker's Landing, Beacon Rock State Park, and Hamilton Island. Opportunities to camp, picnic, fish, hike, and explore floodplain habitats within the Columbia River Gorge are readily available. Additional opportunities will be provided when major new recreation developments are completed at Cottonwood Beach and Doetsch Ranch.

Boat access to the Gorge Refuges is limited by various obstacles such as stream depth and width, logs, beaver dams, and a fish ladder. These barriers would preclude motor boat access into all Refuge streams. Kayaks and canoes potentially could enter Franz Lake with several portages. Opportunities for non-motorized guided tours of Franz Lake are proposed in this CCP. The Service will impose group size, season of use, time of use, and location restrictions to reduce disturbance and resource impacts per the in Compatibility Determination Appendix K. Public access to the Gorge Refuges from boats moored in the Columbia River will not be permitted. The Gorge Refuges will continue to protect habitat for chum salmon, Columbia yellowcress and other sensitive species requiring relatively undisturbed shoreline and aquatic habitat.

TABLE 3-1. Summary comparison of proposed alternatives (Steigerwald Lake Refuge - SLR, Franz Lake Refuge - FLR, Pierce Refuge - PR).

Issue/ Theme	Alternative A: No Action	Alternative B: Proposed Action	Alternative C
GOAL 1: Protect, restore, and enhance the natural diversity of floodplain, upland forest, and grassland habitats representative of the lower Columbia River ecosystem.			
Emergent Wetland	provide 207 acres at SLR and 9 acres at PR within existing impoundments	- restore and enhance up to 237 acres at SLR and 11 acres at PR within existing impoundments. - attempt restoration on 42 acres at FLR	- reduce reed canarygrass on 212 at SLR and 3 acres at PR along stream margins - attempt restoration on 37 acres at FLR
Riparian Forest	expand forest cover to 293 acres (73 ac increase); target forest fragments and streams	expand forest cover to 418 acres (198 ac restored)	expand forest cover to 389 acres (169 ac restored)
Riparian Scrub- shrub	maintain 37 acres and restore 8 acres at SLR and PR; target salmon-bearing streams	- restore 123 acres (86 ac increase) at SLR and PR - increase native shrub cover on 45 to 95 acres of existing habitat at FLR	- restore 128 acres (91 acre increase) at SLR and PR - FLR: same as Alternative B
Oak Woodland & Savanna	maintain 40 acres at SLR and 28 acres at PR	enhance or restore 134 acres at SLR and 40 acres at PR	enhance or restore 134 acres at SLR and 63 acres at PR
Grasslands	- maintain goose browse on 36 acres at PR and 295 acres at SLR - maintain old field on 96 acres at PR and 105 acres at SLR	- maintain goose browse on 23 acres at PR and 168 acres at SLR - maintain old field on 44 acres at PR and 71 acres at SLR	- maintain minimum amount (138 acres at SLR) goose browse - maintain old field on 47 acres at PR and 119 at SLR
Wet Meadow		attempt restoration on 20 acres	same as Alternative B
Road Density		close and revegetate ~2 miles of existing road on PR	same as Alternative B

Issue/ Theme	Alternative A: No Action	Alternative B: Proposed Action	Alternative C
GOAL 2: Protect and enhance populations of native flora and fauna with an emphasis on State- and federally-listed threatened and endangered species, species of conservation concern, and their habitats.			
Inventory and Monitoring	<ul style="list-style-type: none"> - winter Canada goose surveys at SLR - fish monitoring at PR 	<ul style="list-style-type: none"> - expand goose surveys to PR - fish monitoring at PR - avian point counts at FLR and PR - implement inventory and monitoring program for conservation targets and trust species 	same as Alternative B
Fish Habitat Access	remove or modify man-made barriers on Refuge to improve fish access to 9 miles of habitat	<ul style="list-style-type: none"> - remove or modify man-made barriers in Refuge watersheds to improve fish access to 13 miles of habitat - develop watershed partnerships 	same as Alt. B except improve fish access to 14 miles of habitat partly through removal of dikes and water control structures and soil plug at head of South Hardy Slough at PR
Columbia yellow- cress	facilitate partners to monitor plants and habitat at PR	develop agreements to facilitate monitoring and management	same as Alternative B
Water Quality	minimal participation in monitoring Gibbons Creek, SLR	<ul style="list-style-type: none"> - assist partners to implement Gibbons Creek Water Cleanup Plan, SLR - address contaminants in Gibbons Creek remnant channel, SLR - monitor and improve water quality in Pierce Lake, PR 	same as Alternative B, except splashdown pond and settling ponds would not be constructed at Pierce Lake, because the lake and all other artificial impoundments would be eliminated at PR

Issue/ Theme	Alternative A: No Action	Alternative B: Proposed Action	Alternative C
GOAL 3: Reduce the impacts of nonnative and invasive species on native flora and fauna.			
Invasive Species and Noxious Weeds	<ul style="list-style-type: none"> - map location of key noxious and invasive plants on SLR and PR once every 5 to 10 years; develop GIS - educate field staff and partners about potential for new invasive species - periodically drain Pierce Lake to remove nonnative fish and bullfrogs 	<ul style="list-style-type: none"> - map existing infestations at least once every 5 years; annually survey for new invasives; develop GIS - implement a rapid-response protocol for new invasive species - periodically drain Pierce and Lena's Lake and Domestic Springs pond to remove nonnative fish and bullfrogs - improve coordination with neighbors and other partners - evaluate threats, establish monitoring protocol, determine treatment priorities - develop "watch list" - support research on nonnative plant control 	same as Alternative B except eliminate or reduce habitat for nonnative bullfrog and fish at PR through the removal or modification of water control structures and soil "plug" at head of South Hardy Slough
GOAL 4: Provide management-based research opportunities and conduct Refuge studies to investigate ecosystem dynamics, wildlife and habitat relationships, habitat use patterns, and human impacts.			
Research & Study	make list of high priority research and study needs available to interested parties upon request	<ul style="list-style-type: none"> - implement top ranked studies - implement Outreach Plan to promote research - develop infrastructure and identify funding to support research on the Refuges - establish ≥5 partnerships in support of research 	same as Alternative B
Franz Lake Research Natural Area	no RNA	no RNA	establish 420-acre RNA, and develop RNA Management Plan

Issue/ Theme	Alternative A: No Action	Alternative B: Proposed Action	Alternative C
GOAL 5: Develop and encourage public understanding of and support for the purposes and visions of Steigerwald Lake, Franz Lake, and Pierce National Wildlife Refuges.			
Public Outreach	participate in 3 public outreach events each year and develop Refuge brochure and website	<ul style="list-style-type: none"> - hold 3-5 outreach events on Refuges; participate in 2 off-refuge events each year - hold 1 volunteer workday on each Refuge per year - facilitate formation of Refuge Friends group - work with adjacent land managers to integrate Gorge Refuges in public media - place Refuge signs (entrance sign style) to identify each Refuge from State Route 14 	same as Alternative B except: <ul style="list-style-type: none"> - 4 outreach events on-refuge; 3 off-refuge events each year - hold 2 volunteer workdays on each Refuge per year - partner to procure/maintain traveler information radio station with information on Gorge Refuges
Environmental Education	<ul style="list-style-type: none"> - authorize non-Service group and Service fisheries program to conduct outdoor education at PR for up to 180 students annually - provide resources and guidance for Refuge visits and classroom activities 	same as Alternative C except also conduct in-class programs, coordinate 2 teacher workshops each year, provide guidance on community and Refuge service projects, and coordinate Site Development Plan for PR	<ul style="list-style-type: none"> - establish EE program targeting local schools - designate outdoor education sites at SLR and PR - address safety at railroad crossing on PR - develop educator's kits for Refuge visits and classroom programs
Interpretive Program	<ul style="list-style-type: none"> - Implement Gateway Center and interpretive trail at SLR - update Franz Lake overlook 	In addition to Alternative A: <ul style="list-style-type: none"> - develop interpretive signs at Steigerwald overlook - offer a guided kayak and canoe tours of Arthur Lake - cooperate with Town of North Bonneville to develop wildlife viewing on existing trail at boundary of PR 	Same as Alternative B except do not develop the wildlife viewing trail at the boundary of PR and Town of North Bonneville. Also, develop a "virtual tour" of Gorge Refuges on Refuge Complex website.
Columbia River Dike Trail (SLR)	officially open trail to the public but close east 0.6-mile segment to horseback riding, bicycles, dogs, and jogging. Monitor uses to ensure compatibility.	<ul style="list-style-type: none"> - officially open trail to public, allowing existing, compatible uses by pedestrians, leashed dogs, bicycles, horses, and joggers; monitor uses - partner with Cottonwood Beach Park to provide information at kiosk 	same as Alternative B

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